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RUWENZORI: FLIGHTS AND FURTHER EXPLORATION:

A paper read at the Evening Meeting of the Society on 23 January 1933, by

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IN 1906 the Duke of the Abruzzi made his completely successful exploration of the snows of Ruwenzori, climbing and mapping the snow mountains and making the ascent of most of their snow peaks, of which only one had been previously climbed. However there remained work to be done. The Duke's expedition had reached the snows by the valley of the Mobuku which flows eastwards from the glaciers. The main stream of the Butawu, flowing west from the main peaks, had also been explored, but north and south of the snows and of these two valleys were large areas completely unknown. Only two named snow peaks, Johnston and Weismann, remained unclimbed, but below the snow-line the massif bristled with rocky peaks which had never been attempted. Our two expeditions of 1926 (*Geogr. J.*, vol. 69, p. 516) made the second ascent of Mounts Stanley, Speke, and Baker, climbed Johnston peak, and completed the first crossing of the massif *via* the snows, passing through the middle of the northern unexplored area. Since then no progress had been made in exploration, though two members of the Massee expedition reclimbed Mount Baker and, early last year, H. W. Tilman and E. E. Shipton made the first ascent of this mountain from the north and also the third ascents of Mounts Stanley and Speke.

The chief object of the British expeditions last year was the collection of plants and seeds of possible horticultural value, and in fact nearly four hundred packets of seeds were sent home by air and 60 lb. weight of plants brought back by air on the completion of the expeditions. At the time I had planned to leave England, in July 1931, the Air Survey Company, who were filling a contract with the Egyptian Government for an air-photographic survey of the White Nile basin, were expecting to move their air base to the Western Province of Uganda, and I was able to arrange to charter one of their machines for two reconnaissance flights as a preliminary to exploration. At their suggestion I agreed to pay for the charter of the aeroplane by working for them for two months as medical officer and surveyor. As this work was then thought

to be nearing completion it was considered necessary for me to go by air, and I took a return ticket to Butiaba by Imperial Airways, being their first passenger from England to be landed on Lake Albert. The day before my arrival in Uganda the Air Survey Company had had the misfortune to lose two of their personnel in a flying accident, and I filled a gap by working as air photographer. On the completion of the two months it had not yet been possible to spare a machine for my reconnaissance flights but, being in Fort Portal, I visited Bikoni hill which I had chosen as a first collecting station. This was in September of the year before last, and I found that in the foothills the plants, unlike the vegetation of higher zones, appeared to have definite flowering seasons and were at this time just coming into flower. Weather conditions moreover were abnormal; rains should have stopped but were at their height, and the mountain streams were in flood, so that it would be difficult to get porters for an expedition to a higher zone. In these circumstances I accepted an offer to continue working for the Air Survey Company until an aeroplane should be available for my charter. This had an advantage that funds would thereby be provided for more extended expeditions.

Reconnaissance flights: December 1931

During the next three months air-survey work took us frequently within sight of Ruwenzori. At sunrise and for half an hour or so the peaks were clear, but long before the sun was high enough for photography, and before the mountains could be reached from the aerodrome at Masindi, the snow peaks were enveloped by cloud and remained hidden for the rest of the day. On December 13 however, while flying south-west from Masindi in order to do routine air photography between there and the snows, we saw that the peaks remained clear well after the usual hour of their eclipse. It was a two-hour flight from Masindi to the mountains, and during this time, while climbing steadily on a straight course for the highest peaks, I was on tenterhooks lest, as had happened so often previously, we should see the bank of clouds, which hangs round the base of the massif at night, rise and smother the peaks before we could reach them. The machine was a 120-h.p. Gipsy III De Haviland "Puss Moth," the camera a Williamson "Eagle VIII," and P. W. Lynch Blosse was the pilot. Owing to the skill of E. W. Bishop, the engineer in charge of overhauls, we had never had a forced landing, so there was no anxiety apart from the question as to whether the peaks would remain uncovered. As we neared the massif the most striking feature was its shape, a level elliptical peneplain. Were one, by two curved incisions, to cut loose an elliptical section of the peel of an orange and then squeeze the orange until the detached section of skin stood out above the surface of the rest of the orange, one would get the general effect of Ruwenzori standing out above the main plateau of that part of Africa. The next most striking feature of the massif was the deep valleys radiating from the centre, the valleys starting and ending shallow and being deepest at the point corresponding to the crest of the intervening ridges. The normal ceiling of the machine was about 16,800 feet, which is the height of Margherita peak, and at that height we flew over Scott-Elliot pass, between Mounts Stanley and Baker. Here we met an up-current due to the deflection of the westerly wind, and the machine shot up to 18,400 feet. Turning round

Mount Stanley

Looking north from Weismann Peak, the summit of Mount

ummit of Mount Luigi di Savoia

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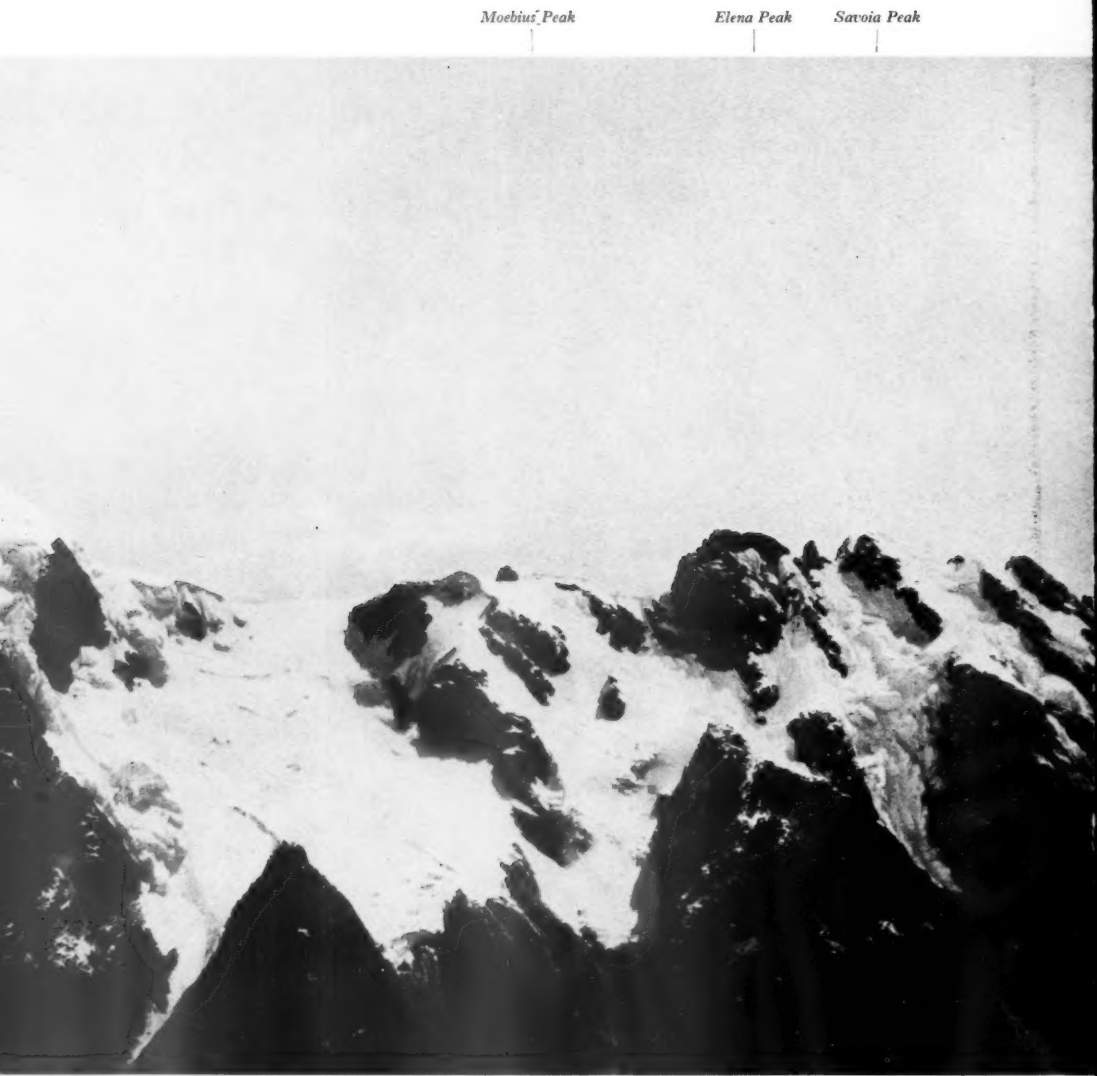
Crest, N.W. shoulder, Margherita Peak
Margherita Peak
Alexandra Peak



Air photograph of Mount Stanley and part of Mount Baker, looking north-east

f Mount Stanley and part of Mount Baker, looking north-east

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slowly so as not to lose height we flew back over the top of Margherita itself. The peneplain of Ruwenzori as seen from above was divided into two by the central snow mountains which appeared as buttons of white, not strikingly higher than the rest of the plateau represented by the ridges radiating from them. A closer observation showed certain minor differences between the northern and southern plateaux. In the north the valleys were deeper and the ridges sharper. Although we had crossed this plateau on foot in 1926 yet the main features remained unknown, for we had travelled at the bottom of the valleys and a view of the ridges was prevented by the pall of mist which hung not far above our heads. The Duke of the Abruzzi had considered that there might yet be snow peaks undiscovered in this area. Now, flying backwards and forwards over the northern plateau on a perfectly clear day, we were able definitely to establish that there was no snow peak north of the six snow mountains already known. We had expected to discover in this area lakes, possibly larger than those already known in Ruwenzori, but in this we were disappointed, as no new lake of any considerable size was seen.

Our most interesting discovery in the northern plateau was that the Lamia has its source on the ridge joining Mount Gessi and Mount Portal, about 8 miles from the point which has hitherto been taken as the source.

There was a striking diminution since 1926 in the size of some of the lakes of Ruwenzori. Buyugu lake was surrounded by an area of mud whence the water had receded, and of the three lakes we had discovered in 1926 that at the headwaters of the Mugusu was now empty, and of the two in the upper part of the valley of the Ruamuli the lower was now quite dry and the upper was a mud flat with a small pool in the middle. Another piece of water which had dried up was a small lake discovered by the Italian expedition in 1906 near the left bank of the tributary of the Butawu running west from Hamugoma (Freshfield pass), and still full when seen by us in 1926.

As we flew round each of the six snow mountains I was struck by the recession of the glaciers since six years ago. Areas of rock recently uncovered showed up clearly, being light-coloured in contrast with most of the exposed rock which appeared black from the covering of lichen. Alexandra peak, which was snow-capped in 1926, was now, at its highest point, bare rock, as was the peak known to us as Spot peak, or Ensonga, at the north end of the high ridge of Mount Speke which we had traversed in 1926.

West of Mount Stanley, at the foot of the glaciers, the Italians had discovered two lakes. The lower of these as seen from the air was a brilliant emerald green. We now saw a third lake which in remarkable contrast with its neighbour was chocolate brown.

The southern plateau had never been penetrated, though the main peaks had been fixed by triangulation. Of these, R2, R14, and R17 were described as snow peaks, but from the air they appeared to have only a sprinkling of fresh snow. The valleys of the southern plateau, unlike those of the northern, had many lakes. We noted over twenty lakes not previously known, and later, during expeditions on foot, were able to add to the number. Most striking among the lakes was a chain of eight along the valley of the Nyamgasani, two of these being the largest lakes in the massif. We also flew over the crater lake on the ridge above the rock-shelter Nyinabitaba. This is the only known crater

lake in the mountains and was first visited by the British Museum Expedition of 1906. From the air it appears as a perfect example of cauldron subsidence, being surrounded by an inner and outer ridge, between which is a complete ring of water.

Native villages extend usually up to 7000 feet, at which level is the beginning of the forest zone. There is a tendency for the limit of habitation to be extended upwards, partly owing to destruction of the forest and partly because of the cultivation of wheat and other crops which flourish at a higher level. We saw several villages at about 7500 feet. These were on ledges on spurs from the main ridges, well within the forest zone. We noticed one particularly neat village of a few huts on a ledge with a steep slope above and below the clearing, and decided to fly down and look at it. My experience had been that natives of Uganda showed no fear of aeroplanes, which they considered merely as a contrivance of Europeans. When the aerodrome at Masindi had been completed and I arrived in the first aeroplane to land there, the natives showed no fear, and the only difficulty was to prevent them from walking into the propeller; and when taxi-ing across the aerodrome it was sometimes necessary for the observer to get out and threaten the natives, who thereupon disappeared like chaff down wind. However, on throttling down and gliding towards the mountain village we saw the inhabitants rush out of their huts and fall down in terror; we immediately opened up and climbed out of their neighbourhood.

Ten days later another opportunity occurred for a flight over Ruwenzori. This time I took a Bell Howell standard "Eymo" movie camera with me and filmed the snow peaks from the level of the summit of Margherita. Unfortunately after exposing 200 feet of film the lubricating oil froze and the camera jammed. These flights were, as far as was known locally, the only flights which had been made over the mountains.

Third Ruwenzori Expedition: February and March 1932

On February 17 I reached Fort Portal for my first 1932 expedition, which was based on Captain Naylor's plantation at Kyehunda. This is in the neighbourhood of Ibanda, but on the left bank of the Mobuku. This is a disadvantage, as the river is often impassable for days during flood, and even when it is fordable the porters are unwilling to wade through the river in the early morning, which may delay a start. The comparative advantage however lay in the fact that the rest-house at Ibanda had been burnt down and not replaced, so that there was no convenient base on that side of the river. Plenty of porters were forthcoming, as Ibanda had been the invariable base for all expeditions to Ruwenzori from the east, and there were many porters who had been with us in 1926 and with other expeditions subsequently.

It was customary to give the porters a cerebos salt tin full of *bulo* (Eleusine corocana) flour besides salt and blankets. This amount of flour corresponds to a native measure, a *kiraba*, which is about $1\frac{1}{8}$ lb. Loads are made up to 45 lb., which is rather less than the weight of loads carried on safari on the plains; moreover a day's safari is much shorter than elsewhere, and there are numerous halts either because of difficulties in the way, or for rest, or in order to make a fire for warmth. Ideally one should take all loads with one and send men back as loads are used up. This is however not often possible as the porters are

seldom all ready to start with the expedition. Moreover during the journey men often go sick or fall out for other reasons more quickly than the loads of food are used up. It is important that if possible there should be two Europeans on all expeditions. If there is no European with the cutters who make a way in advance of the porters the natives will often go off at right angles to the direction selected, either because the path is easier or for some reason known only to themselves. If there is no European at the rear of the party groups of porters, on reaching a convenient rock-shelter, will decide to camp there instead of catching up the main party. I was able to arrange with G. Oliver to come with me. His first mountaineering experience had been with our second expedition in 1926, and since then he had been a member of the Massee expedition and had, with Goodrich, made the third ascent of Mount Baker which he had previously climbed with us.

The first day, after the usual delays in starting, we made a half-day's journey in very heavy rain to Mihunga, which had been the headquarters of the British Museum Expedition of 1906. A hut is still standing though the roof has fallen in. Here, at 7000 feet, is a small village, the last on the way up the valley. The next day, in rain and mist, we travelled to the rock-shelter Nyinabitaba, where we encountered native hunters on their way down with hyrax which they had caught in traps. These they offered for sale at a shilling each, or the meat or pelt separately at sixpence. I bought a supply of fresh meat which was not unlike the flesh of guinea-pig, which I had eaten as a prisoner of war in Germany, but tough. The next day we passed Kyanasabo rock-shelters and camped at the rock-shelter Kitandara, and the next day reached the rock-shelter Kigo. North of this is a high cliff, and just beyond it is another peak which had a little fresh snow, and immediately beyond this peak, and apparently part of it, permanent snow could be seen. No snow-cap or glacier had been mapped between Kigo and Mount Gessi, so that if the permanent snow were part of the peak we could see just north of Kigo we were looking at an uncharted peak. In 1926 we had the same view of the peak, which was known to us as Mystery peak, or Ekyensita, and, later, with the unfulfilled hope of getting a clear view of this peak, we had twice repeated our ascent of Johnston peak. During our flights over the mountains this was the one peak which remained covered by cloud. We had circled round it and had a glimpse of snow, but not clearly enough to see if it was permanent or only from a recent fall.

Until now we had been following the way discovered by the Duke of the Abruzzi and followed by later expeditions up the main valley of the Buyugu. The next day however we passed into the unexplored valley of the Bukurungu. This valley was entirely unknown to our porters, as for some reason it was not a hunting ground, perhaps because of the lack of rock-shelters. Progress was slow owing to dense vegetation through which a way had to be cut. The valley was steep and we passed some beautiful falls in the river just below where it was joined by the Mijusi. That night we camped in the open at the junction of the east and west Bukurungu streams. The lower part of the valley was narrow, and no explorer had been able to look into it from mountain peaks, but higher up the valley was more open and views into it had been obtained by the Duke of the Abruzzi, whose map shows the two lakes at the headwaters of the Bukurungu.

We first visited the eastern lake. This was surrounded by marshy ground whence the water had receded. At the rim of the lake was a line of rush with dark foliage which from a distance gave the lake a curiously cartographic appearance. The lake has now no surface outlet, but its surplus waters pass underground to reappear as the East Bukurungu stream. From here we passed over a low divide to the headwaters of the Lamia which had been seen from the air to rise from the ridge between Gessi and North Portal peak, instead of where it had been assumed to rise. The divide at the source of the Lamia was a low ridge and offered an easy pass between the two basins. North Portal peak is known to the natives as Hamuguti, Mid Portal peak as Kihuma, and South Portal peak as Rutara. On this as on subsequent occasions we were unable to find the native name of Mounts Emin or Gessi, in spite of their striking similarity in height, size, orientation, and shape, and the fact that they are the most northerly of the snow mountains and outstandingly conspicuous from the native paths crossing the massif north of the snows.

The vegetation in the Bukurungu valley was not different from that of the valleys already known, except that here we found, at about 13,800 feet, a *sibthorpia*, apparently co-specific with *s. Europaea*. From the divide we travelled to West Bukurungu lake, a beautiful sheet of water tucked in at the head of the valley at the foot of Mount Gessi. The lake showed a very recent drop in level and had, like the East Bukurungu lake, no surface outlet. The watercourse of what had been the outlet of the lake was now the bed of a stream running into the lake. We camped at a beautiful spot overlooking the lake and facing Mount Portal with its peaks and high ridge flecked with snow. A traverse of this mountain would make an interesting climb. Rutara, at the south end, is a particularly attractive peak, having a spire-like summit as its name would suggest, *rutara* being the native name for the long conical baskets built round heavy native head-loads so that the point may be rested on the ground during halts.

On the ridge running north-west from Hamuguti towards Mount Gessi was a cliff with a rock having a remarkable resemblance to a Trafalgar Square lion. So far it had rained every day and we had not seen the sun, but this evening for a brief interval the sun came out and we were struck, as one always is on Ruwenzori during the rare occasions of sunshine, with the amazing beauty of the landscape. The opening of the flowers of the *mwalika*, the shrubby everlasting, quite changes the appearance of the landscape at 14,000 feet. In normal misty weather the flower heads remain tightly closed and, the outer aspect of the involucre being of a dull straw colour, the plant is inconspicuous; but when the flower-head opens, the inside of the involucre being a glossy white the plant has a most showy appearance. A large number of swifts appeared suddenly and made a musical twittering; and the *mtaihe*, the peacock-blue sun bird of Ruwenzori, flew from one lobelia to another.

We were too close under the ridge running south from Gessi to get a view westwards, but next morning in a dense mist we fixed our Whymper tent on the top of a small peak at 14,500 feet, south of Ekyensita, and sent the porters back to camp. During this day it did not rain, but the thick mist never lifted and we got no view in any direction. There was heavy snow at night and early the next day; during the morning however, though the heavy mist remained,

Air photograph, looking north-east: Margherita Peak in foreground, Mount Speke, and, in distance, Mount Emin

The twin peaks of Mount Stanley

Air photograph looking south-west: in foreground Margherita Peak, Alexandra Peak beyond

N.W. shoulder of Margherita Peak, summit of peak on extreme left, and Alexandra Peak beyond

there were occasional rifts through which a view could be obtained, and at last we got a clear enough view of Ekyensita to be certain that the snow on it was not permanent. The permanent snow seen from Kigo and which appeared to be on this peak must have been part of the glaciers of Mount Gessi.

The porters came up for us at noon and we returned to camp. It was a wet dawn next day and it rained, sleeted, or snowed continuously until 2 p.m., when we explored up to the head of the valley but failed to find a site for a higher camp. The following day in the usual snow or rain and with continuous mist we climbed to just below the high ridge without being able to find a site for a camp near enough to wood. It was bitterly cold and we were well above phanerogamic vegetation, but while actually on snow I put up a hyrax, which was killed by the porters, and this incident revived their spirits. Eventually we made a new camp, not far from wood, at 13,900 feet and 200 or 300 yards below the glacier. From this camp in mist and occasional falls of snow we climbed up until we were stopped by sheer walls of rock on either side, a wall of ice in front and a roof of ice above. We returned to camp and at dawn the next day, in sunshine which lasted for about twenty minutes after sunrise, we found a way to the top of the main ridge between the glacier and our route of two days earlier. We followed the rocky ridge northwards, there being glaciers flowing east and west. The mist was less dense than usual and we were able to look down on the point we had reached the day before; seen from above it looked so steep that we wondered we had reached so far.

The ridge consisted of a piled-up mass of disintegrated rock, and while traversing along the western side of the ridge I dislodged a mass of rock and was carried by it on to and down the glacier into a small crevasse where I wedged. A further fall of rock took place a few seconds later, and Oliver saw two large boulders shooting down the glacier towards my head; just before they reached me they collided and shot apart, one passing me on one side and one on the other. I was struck by a number of smaller pieces of rock, one of which fell on my right forearm, fracturing the ulnar bone. Improvising a sling with a piece of cord we continued the traverse to where the ridge was replaced by the snow-cap, up which it would be necessary to cut steps. Previously I had done such step-cutting as had been necessary, but now Oliver went ahead, cutting steps from my instructions. There is no technical difficulty in the ascent of this mountain, but the mist had got denser and it was snowing more frequently. We reached the summit, Iolanda peak, at 4.15, this being the second ascent of Mount Gessi. Unfortunately the country to the north, unexplored except for our crossing in 1926, was not visible, but we got several clear views, for a few seconds at a time, of Mount Emin and noticed that, except for the short glaciers from Umberto peak, it was without permanent snow. During our return the mist thickened and snow or sleet became continuous. Handicapped by one arm being out of action, darkness found us still above vegetation. I had a folding candle lantern but this being knocked during the descent at a difficult place the candle fell out and was lost. Eventually we got within sight of the camp and shouted to the porters who started towards us with hurricane lamps. They lost the way and got held up at a precipice and could find no way forwards or backwards. With the help of the rope we reached them and all got back to camp at 9.15.

N.W. shoulder of Margherita Peak, summit of peak on extreme left, and Alexandra Peak beyond

Air photograph looking south-west: in foreground Margherita Peak, Alexandra Peak beyond

It had been my intention to repeat ascents of Gessi until a clear day should enable us to start a plane-table sketch of such parts of the northern plateau as were visible from the summit; but in view of the persistence of bad weather and not wishing to delay too long in case my arm should require re-setting, I decided to carry on with another part of the programme, which was the exploration and mapping of the valley of the Lamia. We therefore next day crossed the divide and started down that valley. That night we reached the penultimate floral zone, the *lobelia Bequaertii* replacing the *l. Wollastoni* of the highest zone, and camped on a knoll covered with tall tree heaths. The next day it rained exactly all day, and we stayed in camp while I dealt with my collections. On the morrow we continued down the river, on each side of which was level ground with luxuriant vegetation, among which was a tall dipsaceous plant, which we had not seen in other valleys, with large flower-heads with cream-coloured flowers. We camped that night at a small island near where a tributary of the Lamia came in on the right bank. There had been showers during the day but the mist had been less dense than usual, and we had been able to make a plane-table sketch of the valley. At night we reached the next lower zone characterized by the *lobelia Stuhlmanni*. The sun came out for half an hour before it set and emphasized the beauty of this zone, which is perhaps the most attractive of the several belts of vegetation. There were large clumps of the sweet-scented *hebenstretia*, the rose-like flowers of the *makere*, *rubus runssorensis*, and with the burst of sunshine appeared enormous numbers of the small blue butterfly, *cyclyrius aequatorialis*, with a small metallic green spot on the under surface of each underwing. These butterflies cluster especially on the *helichrysum fructicorum*, a plant with bright yellow flowers and the general appearance of the yellow garden *alyssum*.

During our journey the next day the valley got narrower, and soon after we had started the men whom we had sent on ahead left the valley, contrary to instructions, and cut a way vertically up the ridge which runs west of and parallel to the river. We were obliged to follow them up to the top of the ridge. The vegetation here was so dense that we could not see the river, and we made the men cut a way back to the valley. Continuing along the left bank we passed a used rock-shelter with a zareba which appears to be characteristic of rock-shelters on the Congo side of the massif. This shelter we afterwards found out was known as Bugoro. It had been a typical overcast day with occasional showers, and we camped at a group of three small unused rock-shelters at the foot of the ridge. The next day it rained almost continuously, and the men became numbed with the cold as they had been unable to light a fire during any of the numerous halts. We camped uncomfortably among the bamboos, and during the next day's journey we were still in the bamboo forest. We crossed the river three times this day with difficulty increasing with the volume of the river.

Our next camp was again in the bamboo forest. As we continued our journey next morning along the left bank of the river the valley became narrower and the river too deep to cross. We had now reached the point where the river had been thought to rise, and as the river below this point was known from native reports we climbed to the top of the ridge where, as we expected, we found a native track. We were now in the zone of mixed forest which is found just below

the bamboo zone. The native path was a narrow way cut several feet deep into the solid rock. This puzzled us as although native hunters follow this ridge up to 13,000 or 14,000 feet there is no defined track at 11,000 feet, the upper limit of the bamboo zone. We found that this track, cut deep into the rock, extended to the lower part of the bamboo zone. Probably it had been formed by countless generations of natives dragging bamboo poles along the crest of the ridge down through the mixed forest zone to the villages which extend up to 7000 feet, the lower limit of the forest. It was now an easy path, downhill and no cutting to be done. As soon as we emerged from the forest we got a beautiful view of the Congo plains. We had completed the second crossing of the northern plateau and of the massif *via* the snows and were now again in known country. We soon passed a boundary cairn which had been placed in position by the Anglo-Belgian Boundary Commission of 1908.

The Lamia since our last crossing had been impassable but near the foot of the hills was a ford and on the ridges above the ford were villages, one in the Belgian Congo and the other in Uganda. On reaching the Congo village the chief assured us that he had no food of any kind to sell, and encouraged us to pass on to the village on the Uganda side where we should find food in plenty. As we started downhill towards the ford we noticed a great commotion in the village on the opposite ridge; the natives rushed out of their huts and began to stream uphill towards the forest. Our men shouted that we were English and Batoro, and this arrested the flight, and after considerable hesitation the chief came to meet us, and when he became convinced of our harmlessness sold us food and gave us shelter for the night. The rest of our journey along the western foot of the mountains and over the Bwamba pass to Fort Portal was through country too well known to be of special geographic interest.

Fourth Ruwenzori Expedition: April 1932

Our next expedition of 1932 was again based on Kyehunda, which I left on April 4. Oliver had been unable to decide if he would come with me on this expedition, and I started without a European companion, journeyed past Mihunga and camped in the open on the spur between the Mahoma river and the main stream of the Mobuku. The next day, passing the rock-shelter Nyinabitaba, we travelled up the ridge to the crater lake, by the shore of which we camped. The lake is a gloomy sheet of water surrounded by trees. It was not known to have an outlet and no outlet had been visible during our flights over the lake. The next day we moved into unexplored country and passed round the lake, discovering an outlet into the Mahoma valley. The water of the lake was without life visible to the naked eye, and there were no water-lilies or other flowering plants on its surface; nor were there dragonflies, for which a special look-out was being kept. The next morning cutters were sent on ahead to make a way to the unexplored Kurugutu valley, which seemed the most likely route to our next objective which was Weismann peak. The Mahoma valley was found to be short and the river did not rise in the neighbourhood of the snows of Mount Luigi as had been suggested. I stayed back in the neighbourhood of the camp for collecting and photography, and then followed the cutters. We passed magnificent podocarpus trees and many tracks of leopard, buffalo, elephant, and hyrax.

We were now at the junction of the mixed forest and bamboo zones. The path of the cutters was found to change abruptly south. This is the manner of cutters when no European goes ahead with them. I sent for the cutters and made them cut a way back to the valley of the Mobuku, where we camped. Next day we followed up the Kurugutu, crossing the river several times and encountering very heavy rain. Leaving the river we climbed a steep ridge, passing four rock-shelters, two of which had been used by hunters, and in one was a store of food. We found out later that this group of rock-shelters was known as Ibanda. Near here, at 10,950 feet, we camped. We now had only four days' food remaining, so I left some loads in one of the rock-shelters together with a number of calico bags of seed hanging on a line to dry. These seeds had been collected in the pouring rain, and there is seldom any opportunity of drying seeds except in a rock-shelter. I now sent back men with exposed photographic negatives and seeds and to bring back further loads of food. I may here mention how much I am indebted to Dr. Schofield, of the C.M.S. Mission at Kampala, who received and developed my negatives and advised me on photographic matters.

With porters now reduced in numbers we continued up the Kurugutu valley, passing many rock-shelters, none of which showed signs of previous use. We were now in the region of the yellow-flowered *hypericum ruwenzoriensis* and the beginning of the penultimate floral zone. Farther on we came to the tree heaths, and here we found a large lake-bed which was covered with *alchemilla*, but had not been long enough dry for the growth of trees. We camped at 11,750 feet after climbing a steep hill. Above us was a high ridge with three gaps. By the camp was a tall clump of the first specimens we had met in this valley of the orange-flowered *hypericum Bequaertii*, known to the natives as *musororo*. The next day I sent back further men with photographic plates and to bring up loads of food, and we continued up the Kurugutu valley. Soon after the start Oliver caught us up with ten porters carrying light loads. During this day we passed many more rock-shelters. Some of those passed first showed signs of use, but those we passed later had apparently not been used; we had now passed beyond the range of native hunters. We passed several more dry lake-beds which had no trees except seedlings nor any except quite young lobelias. At one place the river passed underground from one lake-bed to reappear in another lake-bed lower down. We camped in an enormous dry cave, one of many rock-shelters, at 13,625 feet. The valley here was very narrow and confined between sheer walls of rock with marks of glaciation. The river-bed was choked by enormous boulders. We were now near the head of the valley where is a lake we had seen from the air. That evening Oliver and I reached this lake which lies at the bottom of a circular valley surrounded, except at the exit, by very steep cliffs. Five small glaciers feed the lake, and the stream issuing from the lake had cut its way through a series of ridges of recent moraine. The glaciers all showed signs of recent rapid recession.

The next day I sent back further men to bring up loads and distributed the others for collecting wood while Oliver and I returned to the lake to find a way up to the high ridge of Mount Luigi. There was a heavy mist and occasional falls of snow, and we were unable to find the route we had planned the evening

Air photograph, looking south: Mount Luigi di Savoia in foreground, Nyamgasani lakes and Mount Watamagufu in distance

Air photograph of Mounts Speke and Stanley, looking east

Looking north towards Mounts Emin (left) and Gessi (right)

before. After several abortive attempts we reached the top of the high ridge by an interesting climb up a chimney. We climbed a small peak on the ridge and waited for two hours while the mist eddied round us. Eventually we found we were on a peak between Stairs and Sella peaks, both of which we had climbed in 1926. The high ridge is entirely without permanent snow and the small glaciers on the slopes of Mount Luigi are not fed by snowfields and appear to be fast disappearing.

In 1926 we had seen Weismann peak dimly through the mist for perhaps a second. This time we did not see it at all. We had occasional glimpses in other directions and noted a third Butawu lake; also that the stream rising from the foot of Scott-Elliot pass, in the valley-head known to the natives as Kitandara, flowed into the Butawu proper and not, as shown on maps, into its tributary the Kamusoso. We returned in heavy mist to our dry cave, and after a night of heavy rain and thunder returned down the valley of the Kurugutu to a tributary on its right bank which we ascended, camping in the open at 12,550 feet at the beginning of the highest floral zone, mwalika and *lobelia Wollastoni* replacing the tree hypericum, tree heath, and *lobelia Bequaertii;* the tree *peucedanum* however was absent from this valley.

The next day, after sending back further porters for loads, we continued over a divide at 13,775 feet down a very steep slope into a valley which we afterwards discovered to be one of the headwaters of the Namwamba. The *omukoni* trees on this side of the divide were different from any we had seen. The leaves were nearly glabrous and the long leaf-stalks and main veins of the leaves were beetroot red. These trees had a very striking appearance, being in vivid contrast with the prevailing green-grey and golden brown of the landscape. We next worked our way round a spur and ascended the main valley of the upper waters of the Namwamba to where two streams met. Following the more northern stream we camped at an attractive spot at the foot of an immense sheer cliff. Here we found a two-storied rock-shelter, which novelty intrigued the porters who ran up a broad ledge to the upper story where they immediately started a fire, but a strong wind suddenly rose and blew the fire away, and the men retired to the shelter on the ground-level. At the foot of the cliff was a group of beetroot red *omukoni* trees, and stretching across the valley from these was a lawn-like level of golden brown moss on which were tracks of the snow leopard. A thin fall of water from the top of the cliff formed a fringe through which one looked across the valley. Just where the dry ground met the wet was a ribbon of *arabis* in full flower and sweetly scented.

From this camp next day, after distributing men to take down photographic negatives and bring back food, we explored up the valley and on to a ridge, at 14,000 feet, which was the divide between this portion of the Namwamba valley and that of a tributary of the Kurugutu, the source of which was a lake just north-west of us. There was no direct way from here to the lake and valley as there was a precipice in front of us. To our west was a peak, 14,300 feet. This we climbed, and on the top waited in the mist which gradually thinned, and then, for a few minutes only, the sun came out. For the rest of the time we were on this peak, known to us as Observation peak, or Okuleba, though it remained overcast, and though a little snow fell at times, we were able to fix our position by views we got of Stairs and Sella peaks, of Watamagufu and of

Looking north towards Mounts Emin (left) and Gessi (right)

Air photograph of Mounts Speke and Stanley, looking east

R2, R4, and R17. These three peaks, known to us as Reading, Writing, and Arithmetic, or Okusoma, Okuhandika, and Okubara, were the peaks which had been fixed by the Anglo-Belgian Boundary Commission and described as snow peaks. When seen from the air they had appeared to be but powdered with fresh snow. They were now seen to be entirely devoid of snow, and this together with our observations from the air established the fact that there is no permanent snow in Ruwenzori south of Weismann peak, discovered by the Italian expedition and as yet unclimbed.

From here at last we got a near and clear view of Weismann. It showed, more markedly perhaps than any other peak in the massif, the recent rapid recession of the glaciers. We were now able to see that whereas the eastern drainage from Stairs and Sella peaks is to the Kurugutu valley, that from Weismann is into the valley of the Nyamgasani. It was in the upper part of this valley, as yet unexplored, that we had seen from the air a remarkable chain of lakes. On completing our plane-tabling from the top of this peak we returned to our two-storied rock-shelter. The next day it rained steadily until 3.30, but there was plenty to do with the maps and collections. Five porters with loads arrived in the evening, but as these were not loads of bulo we were still very short of food for the men, so we sent back most of the porters to meet the food coming up to us.

Leaving most of our loads in the rock-shelter we on the following day travelled up the valley of the southerly of the two headwater streams of the Namwamba to the divide between this valley and that of the Nyamgasani, where we camped in the open. It had been a short journey but there had been a strong wind and it was very cold. We were now without food for the men and we fed them on our own food: bully beef, rice, and cheese. It was impossible to say when the bulo would arrive, as when porters are sent back for food no promised reward or threat of punishment will prevent them from resting several days before returning, even if they know that their fellow men will thereby be without food. The porters and ourselves were now on about quarter rations. Our camp was at 13,750 feet, and during the night a strong wind kept up and snow fell. It was not now possible to take the safari forward as the men were too weak to carry loads. We wished to send them back to meet the food coming up, but they wanted to stay in the camp on short rations even with the likelihood of having to return without food at all.

During the following day Oliver and I explored along the divide and got a good view up and down the valley, seeing three small lakes higher up the valley and three lower down. The way to Weismann looked easy. A peak south-east of us forced itself on our notice, perhaps because of our hunger; it had a most remarkable resemblance to a cake. It became a familiar landmark to us during our subsequent wanderings and was known to us as Cake peak, or Keki. On returning to camp we shared out a little of the remaining food and again told the men to go back early next morning and, when they met the loads, to bring them back to us, we intending to continue exploring locally until their return. At the worst we could abandon all our loads and return without food.

The next day we set out to make our attempt on Weismann peak, not knowing if on our return we should find the porters still in camp or the camp empty, and not knowing if loads would arrive so as to enable us to continue the expe-

dition or whether we should have to march back to our base without food and blankets. Anyhow we had to-day. Weismann, the highest peak of Mount Luigi, the only unclimbed snow mountain of Ruwenzori, presented no technical difficulty. The summit was found to be flat-topped and the surface mud whence the snow-cap had but recently disappeared. If the present rate of recession of the glaciers of Weismann and the other snow peaks of Mount Luigi is maintained it will in a few years cease to be a snow mountain. We visited a number of points, any one of which might be the exact summit, and then, while it was yet comparatively clear, I was able to complete much of the plane-table work I had started from Okuleba peak. We had a good view of Okusoma, Okuhandika, and Okubara; being without snow they did not stand out conspicuously from the rest of the high ridge running south from Weismann and separating the waters of the Nyamgasani from those of the Butawu and Lume. However on the ridge separating the valley of the Namwamba from that of the Nyamgasani, Watamagufu peak, although without snow, dominated the landscape in that direction. Later, while still on the summit of Weismann, we were enveloped in dense mist, and in this we made our way back to camp. On arrival we found that during the day loads of bulo flour and salt had arrived, and the men were now able to have all the food they could eat. Oliver and I however were to be on short rations from now onwards.

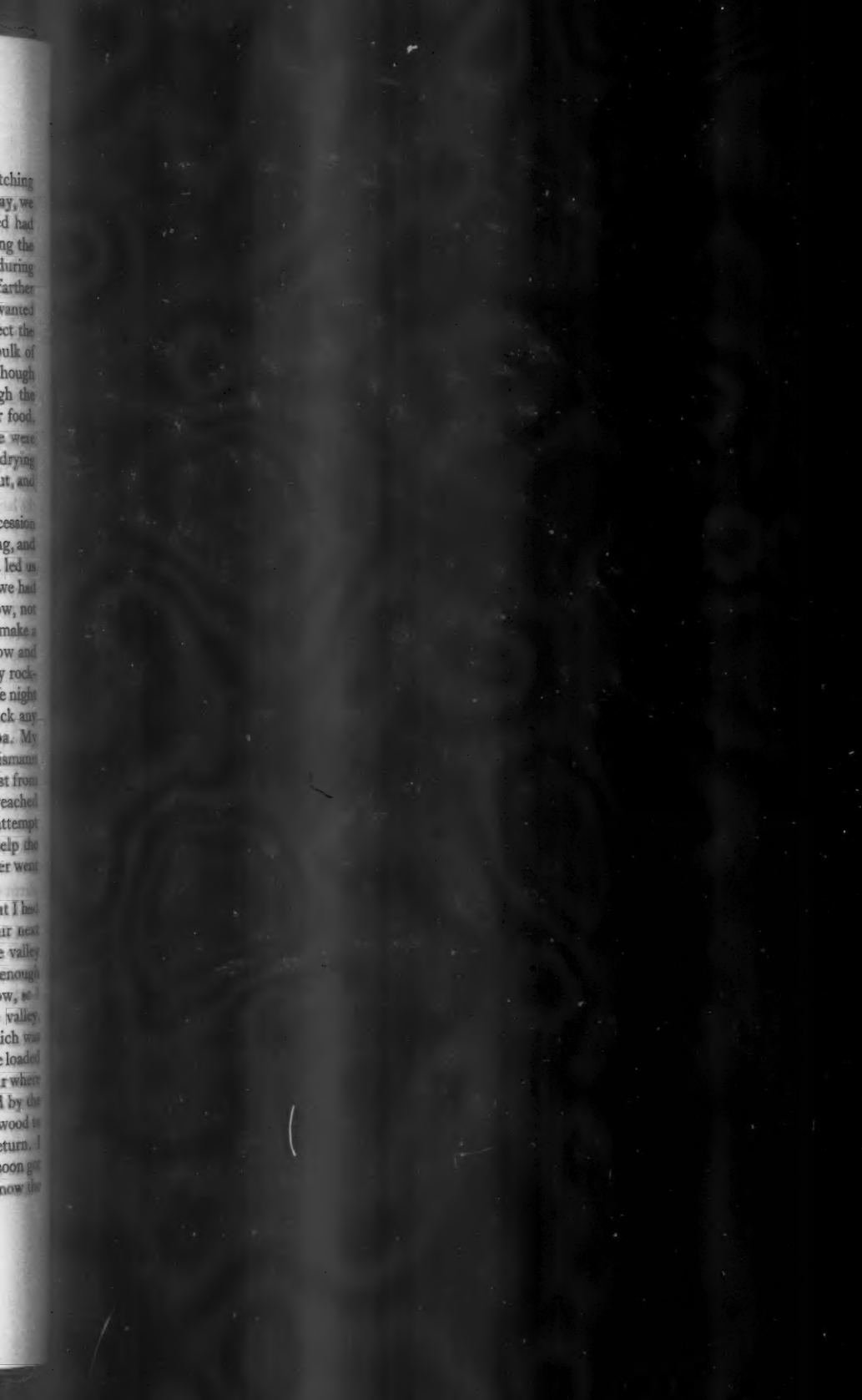
The next day with renewed spirits we explored down the Nyamgasani valley past the fourth, fifth, and sixth lakes. It is a wide swampy valley carpeted with moss and studded with *Carex runssorensis*, and there were signs that the lakes recently had filled the valley. We rested at noon by the biggest omukoni tree we had so far seen; it was 79 inches in circumference 2 feet above the ground. This day was without rain, and fitful gleams of sunshine added to the contentment produced by the loads of bulo flour. During the last part of the day's journey the valley narrowed, and at dusk we camped at 13,380 feet at a point overlooking the seventh Nyamgasani lake. The view from the camp was more beautiful than that from any other of the many camps we had made in these mountains. At dusk I took of this view a photograph for which a long exposure was necessary. The chances were small that the morrow would be fine, and, as it turned out, it was in thick mist that we left camp next morning for our ascent of Watamagufu. It soon started to rain heavily, and as we got higher the rain turned to sleet. But for the mist it is likely that an easy way would have been found, but the only approach to the summit that we could discover lay under a small waterfall, which however mattered little as we were already wet to the skin.

The climbing was difficult because the rock was steep and covered with moss which masked any hand-holds. As we got higher the sleet became snow, which continued until we reached the summit and while we stayed there. Plane-tabling was not possible, but some useful bearings were taken with a clinometer. The descent was even more difficult and uncomfortable, and we returned to camp in still pouring rain. The next day, leaving most of the porters to strike camp and start with the loads up the valley, Oliver and I travelled down the valley past the left bank of the seventh lake towards the eighth and last of the lakes I had seen in this valley from the air. The valley was steep and the vegetation dense, but we were rewarded by a magnificent

view of this piece of water. Returning up the valley with the idea of catching up the porters and getting as far as possible on our return journey that day, we met the whole safari, which for some reason that we never discovered had followed our tracks down the valley. It soon started to rain, and during the rest of this day's journey we experienced the heaviest rain met with during this expedition. The men became numbed by the cold, and we got no farther than the fifth lake. By this time they had reached the stage where they wanted to die, and it was with the greatest difficulty that they were got to erect the tents. Immediately an outer fly had been erected separately for the bulk of the men a fire was started under it with leaves of omukoni trees, and although heavy rain kept pouring during the night and came straight through the Whymper tent, yet the men managed to maintain a fire and cook their food. In the morning the rain stopped and the sun shone. Although as we were short of food we were anxious to press on, yet the opportunity of drying blankets and loads seemed to justify a delay. Everything was spread out, and for the only time during the expedition blankets became dry.

With lightened loads we started at about 11 o'clock and passed in succession the lakes higher up the valley. From 2 o'clock it had again been raining, and by the late afternoon we had reached the pass over the ridge which had led us to the summit of Weismann, passing on the way a rock-shelter which we had discovered during that ascent. At the top of the pass, in mist and snow, not knowing whether it would be possible to get down to wood in time to make a camp, I decided to return to the rock-shelter we had passed. The snow and wind now stopped and that night, at 14,100 feet with no wind in a dry rock-shelter with a clear sky and a full moon, we spent the most comfortable night of the expedition. From here next day we sent back men to turn back any porters who might be met bringing up loads, to await us at Nyinabitaba. My plan was to cross a pass over the ridge which runs north-west from Weismann and so get into the valley of the tributary of the Butawu which runs west from Hamugoma (Freshfield pass). The way down from the pass we had reached the day before proved difficult, and it was doubtful if the men would attempt the descent. After we had found a possible way down I stopped to help the porters and make certain that they did not stay behind; meanwhile Oliver went ahead to explore the gap in the north-west ridge of Weismann.

During several hours I was busy getting the porters down the cliff, but I had seen nothing of Oliver on the way leading to the pass which was our next objective. I then began to hear him calling from some way down the valley which runs north-west from the pass we had crossed. I had now started enough of the porters down the cliff to make it likely that the rest would follow, so I left one of the men in charge and went with another man down the valley. Farther down we came to a deep chute without hand or foot holds which was dangerous without loads and was likely to present great difficulties to the loaded porters. After negotiating this the valley became easy, and round a spur where was the beginning of wood we found Oliver. He had become numbed by the cold in climbing down the cliff and had come down the valley to find wood to make a fire, but had been unable to start one, and was too chilled to return. I was equally unable to make a fire, but the man I had brought with me soon got one started. I then returned to the foot of the chute, above which by now the



West Bukurungu Lake, looking south-east

porters were clustering. It was by this time too late to think of reclimbing the valley and attempting the pass which had been our next objective, and it had become important to find a site for a camp lower down, so I left Oliver to arrange the descent of the loads down the chute by means of ropes and went on alone to find a site for a camp. I soon got into dense mwalika scrub, 7 feet high, through which I tore a way to a rock-shelter I had seen from higher up the valley. Here was a dry shelter with masses of the orange-flowered musororo tree, but unfortunately no water within reach. I then found a way to the stream at the lowest part of the valley where at 13,375 feet was a sufficiently level spot for a camp.

On my way back I met the first of the porters and was able to direct them to the camping site. By the time I reached the foot of the chute Oliver had got down nearly all the loads and porters, but it was dusk before the last of us reached the camp. It was now snowing, and by the next morning the ground was covered with snow. We got off early and continued along the side of the cliff parallel with the stream, passing three previously unknown lakes below us in the valley and rounding the spur separating this tributary of the Butawu from that rising from Hamugoma pass. We camped on very wet ground at the head of the valley, and next day crossed the pass and completed our journey by the valley of the Mobuku *via* Kaijongo and Nyinabitaba rock-shelters through known country back to Kyehunda.

Fifth Ruwenzori Expedition: June and July 1932

Before starting on the next expedition I received a message from the Secretariat asking me to arrange to meet the members of the Belgian expedition which was on its way through Uganda to explore the western slopes of Ruwenzori and came up to Masindi from the shores of Lake Albert for the purpose. Their climbing programme was an ascent of Mount Stanley from the west and also an ascent of Kraepelin peak, an unclimbed peak without snow on Mount Emin. Here only our plans overlapped; those for my next expedition, though chiefly for further exploration of the northern plateau and for plant collecting, included a first traverse of Mount Emin, of which only Umberto peak, the only snow peak, had been climbed by the Italian expedition, since when no climb in the mountain had been made. I received an invitation to become a member of the Belgian expedition instead of following my plans of exploration in the north, and although my arrangements for seed collection prevented me from accepting the invitation I was able to help the Belgians by lending them my copies of such air photographs as might assist them in planning their ascents of Mount Stanley and Kraepelin peak.

The Belgian plan at that time was to ascend the river Ruamiya, or other stream flowing west from Emin, and establish a high camp at the western foot of the mountain by the end of June, so as to make an ascent on the first day possible in July, afterwards forming a new base at the western foot of Mount Stanley. I had not then expected to make my third expedition of last year until November, but later decided to start in June and make a further short expedition at the end of the year for the purpose of collecting living plants to take back with me by air to England. Before starting in June I wrote to the leader of the Belgian expedition that it was my intention, if I reached Kraepelin

before they did, to await them so that we could make an ascent of that peak jointly.

Until now all expeditions to the snows of Ruwenzori had been by the valley of the Mobuku when starting from the east, or by that of the Butawu when approaching the mountains from the west. Wishing to break new ground I decided to attempt a new route to the snows. I had heard from the natives of an old route over the massif following the watershed between the Yeriya and Ruimi rivers to the main divide and then down to Belgian Congo. There are many tracks across the mountains which have been known to natives from the earliest times but which are now less used than formerly, though there is still considerable movement of population from one side of Ruwenzori to the other in order to escape taxation or to avoid interference with native customs. I made my base at Kisomoro, which is on a road and where there is a rest-house. An abundance of porters was immediately available and they joyfully accepted the pay of fifty cents a day and food, blankets being distributed as an advance of pay. Pay on plantations at this time was six shillings a month without food. I was not deceived by the enthusiasm of the porters as they had never been to the snows, and from our experience in 1926 it seemed likely that porters would lose their enthusiasm and start to make trouble as soon as we had passed the last village.

We left Kisomoro in the afternoon of June 22. I had secured through the help of the local chief a guide who claimed to know the track which was called the Kakuka path, as it passed over a hill of that name. During the first day's march the guide took up a position in the rear of the party, and on my asking him if he did not consider that the right place for the guide was in the van, he replied that the matter was immaterial, as up to the next village there was a well-defined track, and beyond that the way was quite unknown to him. This half-day's march was in continuous and heavy rain. The path was the width of the human foot and worn deep into the rock by, as we had concluded, bamboo poles which had been dragged along it from the zone above the mixed forest. We passed the village Kiringabako, and at dusk reached the village Bulinyapowo, situate in a clearing at the lower level of the forest which begins at 7000 feet. In the centre of the village, firmly fixed in the ground, was a xylophone, many yards long, made of tree trunks roughly hewn into planks. We were well received by the chief, and the next morning I got a brother of the chief to act as guide.

Half an hour after our start next day we passed the small village Kalengiso in another clearing, and in the evening camped in the open beyond the forest and bamboos at a source of the Yeriya. The vegetation of the forest and bamboo zones appeared identical with that of the same zones in the valley of the Mobuku. The masses of shell-pink *Impatiens*, called ***ndondo*** by the natives, were the most striking features of the bamboo zone vegetation. At our camp we were already among yellow tree hypericum and tree heath and omukoni trees. It may here be remarked that during this expedition we saw no specimen of the musororo tree which is in all Ruwenzori valleys less common than the yellow-flowered species of hypericum. The next day was devoted to collecting, as the porters who were to have followed us from Kisomoro had not caught us up. I sent back some men to meet the porters or alternatively to buy food at

Kiringabako; other men I sent on to cut a path. Since leaving Kalengiso there had been no sign of a track, and once we had emerged from the bamboos herbaceous vegetation was in many places 8 or 9 feet high. At 3 p.m. the porters I had sent back returned to camp with the porters and loads they had met.

Early the next morning we made a long march along the top of the ridge separating the basins of the two rivers and thence on to the main divide of the massif and south-south-west along this towards the snows, which however were not visible. There was little rain during the day, but the sky was overcast and the clouds too low for a distant view. Rivers running from the main watershed were known by name to the porters: the Ntugutu flowing to Toro, and the Boragani, Semugonoli, and Sindira flowing towards the Semliki. During this march we had passed from the penultimate into the beginning of the highest floral zone. We camped during heavy rain on the top of the ridge among tree heath, inconveniently far from a stream. The porters had been giving trouble during the march because they were unaccustomed to the mountains, but this way to the snows was found to be much easier than the Mobuku route. The next day we continued along the divide, passing the beginnings of several more branches of the Sindira flowing north-east, and then left the ridge, passed round yet another source of the Sindira and camped at the foot of a hill known to the porters as Nangerika.

It had been a short journey with many delays because of the large heath trees which grew close together with low horizontal branches, too big to cut through, which compelled the porters to transfer the loads from their heads to their shoulders while passing under the trees. This caused some of the porters literally to weep, and it was a very discontented safari which dribbled into camp. Luckily there had been little rain during the day and heavy rain did not start until after the camp had been pitched. At the camp were masses of the shrub *Gynura montuosa* with yellow flowers scented like sweet sultan. Here I saw for the first time a climbing yellow-flowered composite with leaves having the appearance and scent of lavender. The most conspicuous plant was however a large spreading tree known as *ngoti;* many of the trees were draped with a climbing perennial gourd with small red berries. The next morning we regained the top of the divide south-west of Nangerika, and during the day got a view of the valley of the Lamia which we had explored earlier in the year. Leaving the divide we cut a path down into the valley of a tributary of the Lamia and were once more in the dense vegetation of the zone just above that of the bamboos.

Once again I was struck by the beauty of the valley of the Lamia. The river at this point flowed through a level valley with a beach on either side and lush water-meadow between the beach and the steep hills which bounded the valley. The beach made the river unlike other streams in Ruwenzori except at the lower parts of their courses. The dissimilarity was increased by the line of tall teasle-like plants growing where the meadow met the beach. We followed the river upstream and then cut a way up a valley on its left bank to a ridge running parallel to the main divide. Here we were in the highest zone of vegetation, and progress was comparatively easy. On this ridge were four shrubby plants: tree heaths, omukoni, *peucedanum*, and mwalika. All these appeared to be dying, and there were more dead than living trees. The

ground was covered with *alchemilla* which appeared to be replacing other vegetation.

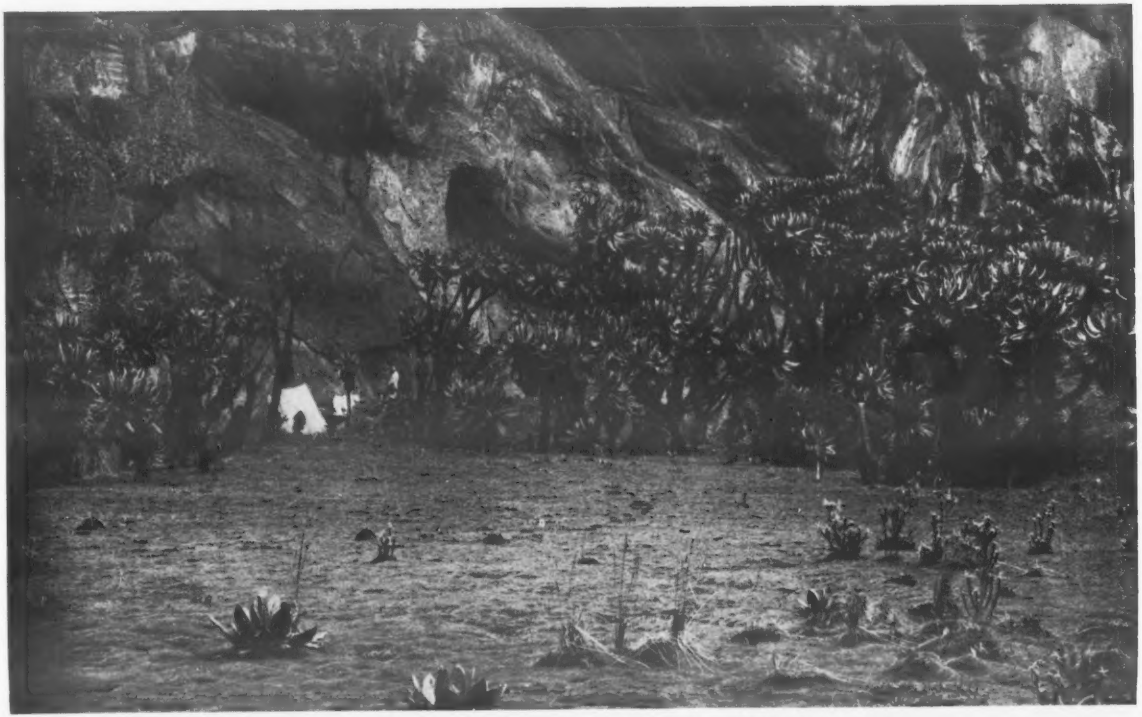
We were now far from water so cut our way down through dense vegetation until we reached a valley which, as it appeared later, is probably the most easterly of the Ruamuli valleys. Here we camped, and in the evening as the mist cleared we had a view of Gessi. The next morning in light rain we made our way through the wet vegetation up the ridge we had left and followed it round two headstreams of probably the Ruamuli to where the ridge ended abruptly. Following the spur down into the valley we crossed a river, a little above a small lake surrounded by marsh, and camped. I had been ahead with the cutters and camped at 3.30, but the men, very sulky, continued to arrive up to 6.30, when it was already dark.

Starting early next morning with the ground covered with frost I went ahead with one cutter up a gully to the top of the next ridge and down a corresponding gully on the other side to a valley with a stream running parallel to the valley we had left; then again cut our way up a gully to the top of another ridge. Here, as there was no sign of porters following, we waited. The sun came out, and almost immediately, it seemed, the vegetation, consisting of moss, *alchemilla*, and the mwalika shrub, became bone dry. I started a fire and flames ran over the hill-top. When the porters began to arrive we forced a way through the mwalika down to the swampy valley, crossing it diagonally below a small lake towards a rock-shelter I had seen from the ridge. This was a perfectly dry but small shelter, and in it we found a cooking-pot which had presumably been left by native hunters but which showed no signs of recent use. This was the first useful shelter we had found on the journey and was known to us as Hunter's Rock-shelter (camp 43). That we had not discovered other shelters was probably due to the fact that we had travelled chiefly along the tops of ridges, shelters usually being found at the foot of the cliffs.

Food was now nearly finished. Before leaving Kisomoro I had arranged that relays of food should be sent on after us. As we had cut the path it would have been easy for the first relay, which was to have started two days after we left Kisomoro, to have caught us up. On the other hand porters without a European might delay to any extent on the way. The day after our arrival at Hunter's Rock-shelter I sent back the head-man with most of the porters, rations for the journey, and money. If they met the porters they were to help them to bring up the loads, otherwise they were to buy food at the first village they reached and return. The porters were unwilling to move and it was not until 10.30 that I got off the head-man with twenty-five porters. I was left with six porters, the acting head-man, or Katikero, and the boy. At 11 a.m. we started up with five loads, meaning to reach the next valley if possible. This I expected would be the valley we had passed down in 1926, at the head of which are many rock-shelters. Owing however to difficulties in the ascent we did not get far enough to see into the next valley but cached our loads under a rock and returned.

The next morning I started early with the boy and one cutter, leaving the Katikero to bring on the porters and such loads as could be brought. The ground was frozen hard and so remained throughout the day. We passed through large areas covered with *hebenstretia* about 4 feet high, the flowers white

River Lamia at point where it had been assumed to rise



Camp at two-storied rock-shelter near the source of the Namwamba

with an orange blotch and sweetly scented. These and the *viola Abyssinica* ceased before we reached the top of the ridge, where the only flowering plants were *alchemilla* and the mwalika. Failing to find a way down west of our last camp we followed the ridge southwards while looking for a way to the next valley. During one of these attempts we found ourselves looking down a precipice at the foot of which was the lake, between Emin and Gessi, which we had reached in 1926 and which I had flown over recently. A descent here was impossible, and we retraced out steps northwards and later reached a point whence we could see the upper of the two shallow lakes at the headwater of the most westerly branch of the Ruamuli. Here however also was no way down, and we went back on our tracks to meet the porters. There was no sign of them, and it was getting dusk. It would be necessary to spend a night in the open.

We returned to a spot where there would be slight shelter from a nearly vertical rock. This was at 14,800 feet overlooking the upper Ruamuli lake some 900 feet below us. The three natives with me were too tired or improvident to collect fuel though it was nearly dark and freezing hard. Before it was quite dark I had collected a large supply of mwalika wood and had scraped away the moss and dug a hole in the underlying peat into which water would drain. Luckily it was a starlight night and almost without wind. We could hear the thunder of the waterfall at the head of the valley below us, otherwise there was no sound. It was an uncomfortable night as it froze hard and we were without food or blankets, and as soon as it was light enough we started back to meet the porters. The lake below us was now covered with ice, but soon the sun rose and during the short interval before the mist rolled up the valley it was almost warm. We soon met the porters. They had found a rock-shelter on the way up and camped there regardless of the fact that we were ahead without food or shelter.

Later we found a way down to the valley below the second Ruamuli lake. This lake, full in 1926, was quite empty when we had flown over it a few months earlier. It now had a small pool of water at the bottom of the lake-bed which otherwise consisted of rock or mud without any trace of vegetation. There was now no water flowing into or out of the lake. Travelling up the valley we skirted the right bank of the lake, passing on firm ground covered with vegetation between it and a cliff which in 1926 had jutted into the lake. Reaching the head of the valley we rested for food, the first that three of us had had since early the day before. Leaving the men to find rock-shelters I climbed the cliff near the waterfall and followed the stream above it through a rain-forest of omukoni trees to its source at a cavern out of which flowed a broad stream of clear water. The cavern was most impressive. The rocks were covered with green prothallus and omukoni trees arched over the stream which flowed silently, in contrast with the distant sound of the waterfall. The only flowering plant here besides the omukoni was the *lobelia Wollastoni*, though lower down I had passed a sweet-scented white thistle.

Climbing to the top of the divide I found that the level of the cavern was, as far as I could judge, exactly that of the lake. Before I could take photographs a heavy mist hid everything from view. A little farther on was the cave where we had slept when crossing the pass in 1926, the ash of our fire undisturbed.

Camp at two-storied rock-shelter near the source of the Namwamba

A heavy fall of snow added to the difficulty of my return to the men who had meanwhile found two large dry caves. The next morning the ground was covered with snow and there was a thick mist. Our food was finished, but there was part of a load at Hunter's Rock-shelter, so as soon as the snow had melted I sent off four of the porters to fetch it and other things and to find out if there were any sign of porters bringing up food to Hunter's Rock-shelter. Dense mist obtained during the day, so I employed the time in dealing with material I had collected since I had sent off the last lot with the porters from the lower camp.

Early next morning I started up Emin with two porters as cutters, leaving the boy to recover from fever and the Katikero to collect fuel. I had noted a possible way to the high ridge of Emin while on the northern spur of Gessi, and this we followed. The cliff was steep and was either covered with dense mwalika or was rock thinly covered with a layer of wet moss. At the upper limit of wood I found a small shelter, started a fire and left the men to recover from the wet and cold. Completing the climb to the top of the ridge I followed it south over a series of rocky peaks until I could get a good view to the west. I could not see either of the named peaks to the south as other peaks intervened. The mountain was enveloped in cloud but rifts allowed a view at one time or another in most directions.

It was now July 6, and according to the Belgian plan they should have been camped at the western foot of the northern part of Emin since June 30. There was however no sign of life or encampment, so I returned the way I had come, collecting the two cutters on the way. On our way down we had snow, sleet, and rain, which added to the difficulties of descent. On arrival at camp at 4 o'clock we found that the four porters had not returned and the Katikero had not left the cave to collect wood but had sat over a fire and used up our entire supply. The next day there was a dense mist which seemed unlikely to lift. The Katikero refused to move, the boy was not yet recovered from fever, and it was useless to send off the porters without some one in charge. The four porters were doubtless at Hunter's Rock-shelter living on the remains of the last load of food. I spent the day exploring in the neighbourhood or waiting by the lake to take a photograph. The mist never thinned enough for me to see across the lake, but I was able to take the first photographs of it from the ground.

The next morning the boy had recovered and I sent him with the Katikero to find the four porters. Leaving in camp one man who was sick, I took the other with me and reclimbed the path we had cut two days ago to the high ridge of Emin. Here I left the porter in a sheltered spot under a rock. The day was much warmer, the mist was less dense, and occasionally a little sunlight filtered through. I followed the crest past the point I had reached before and on over a series of rocky peaks. The rock of Emin is, unlike that of Gessi, hard and reliable. The crest is narrow and consists of enormous pieces of rock with flat surfaces offering few hand-holds. As elsewhere on Ruwenzori peaks, except where the snow-cap has recently receded, the rock was covered with lichen. At some places there was a sheer drop on both sides. At only one place was there real difficulty, where the only way was across a smooth sloping rock with an unclimbable wall of rock on one side and above it, and a sheer drop

below. There were no hand-holds, and it was necessary to wriggle across the rock trusting to friction to maintain one's position. Beyond was a short climb upwards and then a way through a tunnel.

Eventually I reached a peak a few yards away from and a few feet lower than Kraepelin. Between the two was a broad arête. Kraepelin was a dome-shaped summit which offered no difficulty. I walked down to the col to see if I could get a view of Umberto peak without going to the top of Kraepelin, but this was not possible. Returning to the peak I had left, which on a later expedition was known to us as Waiting peak, or Okwetegereza, I stayed there two hours. In case I should be unable to return I left a small cairn to mark the limit of my ascent and started back. I found difficulty at the sloping rock as it was less easy letting myself down on to the rock than climbing up from it. Once past this the way was easy. The porter I found asleep under the rock where I had left him. Except for occasional light falls of powdery snow the day had been fine though overcast. We reached camp at two o'clock, and later on the boy, Katikero, and missing porters arrived with what was left of the last load of food but no news of the relays of food from Kisomoro.

It was now necessary to retire on Hunter's Rock-shelter, but the next day, after arranging which loads were to be left and making all preparations for a start, the men, led by the Katikero, refused to move. The next morning I started them back, and then took the boy with me and reascended the high ridge of Emin on the chance of seeing something of the Belgians, and then followed the ridge north so as to see something further of the valleys of the Ruamuli streams. During this detour I found in full flower a clump of shrubs of a species of *compositae* which I had not seen before. The flowers were bright yellow and made a striking patch of colour, and had there been other specimens within sight they would have been easy to see. Soon after this we were enveloped in thick mist. Trusting to the boy's sense of direction, after we had regained the valley, I let him lead in an attempt to cut back to the track between the two camps. After a time I found that we had been travelling in exactly the wrong direction, so I took a compass course which should lead us in the right direction. After a time the boy suddenly declared that he now knew exactly where we were, and pointed out features faintly visible through the now thinning mist, describing in detail incidents which had occurred at each point. Again I let him lead and for a time all seemed well, but suddenly he turned an ashen face to me and admitted that he was completely lost.

It was now about five o'clock and unlikely that we should get to Hunter's Rock-shelter that night. I again took the lead, and just before it was dark we had reached the top of the ridge running north from Gessi but too far north to be immediately above the rock-shelter. The mist had now cleared but the sky was heavily overcast and snow or rain seemed probable. Suddenly, by the last flicker of daylight, the boy saw in the direction of Kakuka a thin streak of smoke going up from the foot of a precipitous cliff where there was probably a shelter. This might be the camp fire of hunters but was more likely to be porters returning with food. It was then suddenly completely dark. If we could reach the valley east of us it would be easy to follow up the right bank of the stream to the neighbourhood of the shelter. Lighting the hurricane lamp I now tried to force a way through the mwalika, 8 feet high, down to the valley.

The boy, who had been educated at a mission, followed, saying "My God!" at intervals. This attempt ended at a precipice, at which the boy collapsed and begged me to leave him in peace.

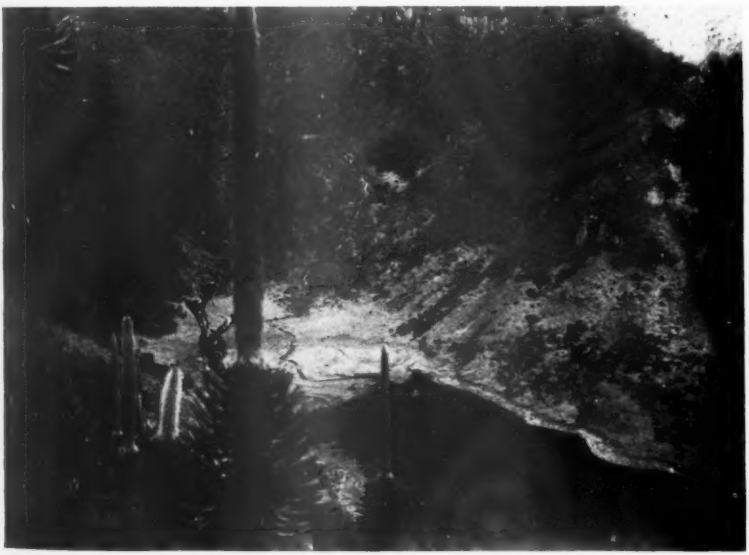
From the top of the hill before it had become dark I had seen a group of rocks just below the ridge to the north. By being rather ferocious with the boy I got him on to his feet and broke a way through the mwalika towards the rocks. It was pitch dark except for the light from the hurricane lamp. The only way to get through the shrubs was to break off the branches by stamping on them with my feet. After two hours of this slow progress we emerged suddenly out of the bushes at the cluster of rocks. Under one of these there was a level dry space large enough for one person to lie down and another to sit. Here the boy collapsed, and I built a fire just below the level ground and kept it going until 4 a.m., when I woke the boy up and made him change places; and in a moment, it seemed, it was daylight. We soon found the way down towards Hunter's Rock-shelter. No smoke could be seen in the direction of Kakuka and, curiously, none from the rock-shelter which the porters should have reached the previous day. On completing our journey we found the shelter deserted. While waiting for the porters the sun came out, the vegetation and our clothes became dry, and the fire which we had lit spread up the hillside. The boy recovered during the short interval of sunshine and thanked me for looking after him during the night. Elaborating the subject he said that our relations, formerly that of master and servant, were now changed and more in the nature of father and son. Developing the subject still further he suggested that in view of our changed relationship I should increase his pay.

Suddenly in the distance we saw porters streaming down a hill from the direction of Kakuka, and in due course there arrived the Nyampara and nine porters and some five loads of food including part of a load of beans, the rest being cassava flour, considered by the natives as being food only to be used in times of famine. The boy and I had had no food since early the day before and made the mistake of eating the cassava before it had been properly cooked. Later the Katikero arrived with the porters whom he had allowed to camp in a shelter halfway down, issuing them with a double ration of food, practically the last of our bulo flour.

It would have been quite impossible to get the men back to our highest camp, so next day I decided to complete the crossing of the northern plateau by a new route between the Lamia and Ruamuli rivers. The Katikero and most of the men refused to go with me, so I gave them enough food for the return journey and let them go. I was left with the boy, the Nyampara, and three porters. The rest of that day and the next two were spent in bringing the remaining loads from the high camp. These were stacked at one end of Hunter's Rock-shelter and the cooking-pot was left in its original position at the other end. The following day we crossed the main stream of the Ruamuli at a point lower than our previous crossing and then climbed over the high ridge to the next valley and camped near the stream. We had no shelter except the Whymper tent, but although there had been the usual rains during the day the night was almost without rain.

The next day we crossed the next ridge and valley and reached a ridge roughly parallel with the Lamia. During the journey we passed a good rock-

Cake-shaped peak on watershed between Nyamgasani and Namwamba



Waterfall and frozen lake just below source of Ruamuli

The only known crater lake in Ruwenzori, at 10,000 feet on the ridge above Nyinabitaba

shelter known as Kirambia and were on the old Kakuka track. We marched until dark and camped in the bamboo zone, five natives and myself sheltering with all the loads in the Whymper tent during a night of almost continuous and very heavy rain. Next day by a forced march along an easy way we reached the first habitation, the village of Kasimba, and completed the third crossing of the northern plateau. Here we found some of the men and loads that had been sent from Kisomoro and learned the history of the relays of food that had not reached us from Kisomoro. The first convoy sent had followed our track until it left the country known to the porters, and then they had returned. The chief at Kisomoro thereupon put them in prison for the night, after which they promised to take the food to us. This time, being afraid to return, they passed over the mountains without going near the snows and reached Bwamba, as did succeeding convoys. We now found these porters scattered through the villages of Bwamba living on our food. We then, during three days, safaried to Busaru, crossing with difficulty the Lamia in flood, and camped at the Government rest-house in Uganda territory.

The difficulties with the porters had not been greater than on our first expedition by the Mobuku valley in 1926, though Ibanda had already been the base of numerous expeditions to the snows. The natives are terrified of going near the snows and none of the porters from Kisomoro had been on a previous expedition. The new route we had followed to the snows is much more direct and easy than the Mobuku route, especially when starting from Fort Portal. From Kisomoro the snows can be reached without crossing a river, as ridges are followed to the Lamia which can be ascended by its right bank to the divide between it and the tributaries of the Mobuku. Here, within easy reach, are the snow mountains and also Mount Portal and its three unclimbed peaks. The weather had, on this expedition, from June 22 to July 20, been on the whole good, though it had rained every day except one. There had been no very cold weather, and snow, when it fell, had soon melted.

Sixth Ruwenzori Expedition: July and August 1932

I spent two days at Busaru collecting the scattered porters and loads. Nothing was missing from the loads except the bulo and salt upon which the men had been subsisting. With great difficulty I got the Nyampara and fifteen porters to fetch the loads left at Hunter's Rock-shelter and arranged that certain loads should be left at Busaru and others taken back to Kisomoro. Other loads I sent back to Kisomoro direct. It was not possible to organize another expedition from Busaru as a native circumcision festival was in progress and porters were scarce. Also further bulo flour was unobtainable. While however loads were being fetched from Hunter's Rock-shelter I decided to visit the camp of the Belgian expedition in order to find out why they had failed to arrive at Mount Emin at the time arranged and whether they had since fulfilled their ambition, a first ascent of Kraepelin peak. I had little Uganda money and no Congo currency, nor European food. When leaving Kisomoro I had told the boy not to pack my mosquito net. I had food for porters and, by a curious chance, a tin of paraffin which, although I had not ordered it, had been sent me across the Bwamba pass by one of the Indian shops at Fort Portal.

Our way was through known country, though the villages we passed through were mostly either not marked or wrongly named on the most recent maps. We exchanged paraffin for food as we went along. Rivers were in flood and the forest at the western foot of Ruwenzori was largely under water. Several rivers were difficult to cross, especially the Jerule where we were held up for four and a half hours until, ascending the right bank, we were able to make a crossing by a tree which had been brought down by the flood and wedged across the stream. At the villages we passed through we made inquiries as to the base camp of the Belgian expedition but could get no definite information, so we decided to go to Beni. Towards the end of the journey we crossed the Semliki and camped on the left bank. The mosquitoes had been bad throughout the journey, but here they were particularly troublesome. After a broken night I called the boy so that I should give orders for an early start. Getting no reply I searched the native huts and found him occupying the centre of a hut, surrounded by admiring natives and having his early morning tea under my mosquito net.

At Beni I was kindly and hospitably received by the officials and learnt that the Belgian Ruwenzori Expedition base was at Mutwanga, which we reached next day after dark. Here were five Europeans connected with the expedition, and from this camp supplies were sent to the main camp in the mountains. I was told that the total European personnel of the expedition was fifteen, including four doctors, or, now that I had joined the expedition, sixteen, including five doctors. The next day I was lent porters to replace mine and travelled on to Kalongi. This had been a village on a spur at the limit of cultivation but was now transformed into a large settlement with a spacious wooden house for Europeans. The vegetation was almost identical with that at a corresponding level on the eastern slopes of the mountains, but near the village I saw for the first time a tall balsam *Impatiens elegantissima*, with flowers 3 inches across and a spur 4 inches long. The flower was white with purple honey-guides and strongly scented, especially at night, like the garden *petunia*.

Kalongi, in respect of its site and level and the fact that it was at the limit of normal habitation, was comparable with Mihunga which, overlooking the Mobuku valley, had been the headquarters of the British Museum Expedition of 1906. From Kalongi the easiest way to the snows would be by the main branch of the Butawu, which rises at the valley-head Kitandara, just west of Scott-Elliot Pass. The more direct route was by the native hunters' track along the ridge north of the river Kamusoso. Several small European expeditions had passed towards the snows by this track, but technical difficulties and limited time and equipment had prevented them from actually reaching permanent snow. This was the route selected by the Belgians as the most direct route from the west.

From Kalongi the main camp could easily have been reached in one day, but my porters would not make the journey in less than two. There were established camps at easy distances between Kalongi and the main camp, and at one of these we camped for the night. During the two days we passed or overtook large numbers of porters carrying loads between the main and base camps. It was interesting to note that the passage of so many men along the

track had, by loosening the moss, exposed the underlying mud, which had been washed away, leaving clean rock. The way was a broad track with bare rock in the centre and a border of mud and broken moss on each side. During the latter part of the march I was suffering from malaria, and every step seemed an effort. It was a great relief when, reaching the top of a ridge, I saw the Belgian camp. It was unlike anything I had seen before in Ruwenzori, and for the moment I thought it might be a figment of my fever. The camp covered a large area dotted with large and small tents and huts connected by duckboard paths made of trunks of omukoni trees. Where the path was steep a hand-rail had been made. A stone monument engraved with the name and date of the expedition dominated the camp, and above this was a wireless mast.

My arrival had been anticipated by telegraph, and I soon saw the leader of the expedition coming towards me. From him I learned that the change of plans whereby the intention of making a high camp west of Emin had been abandoned was due to difficulty in getting porters. This camp had been made instead, and the ascent of Mount Stanley achieved first. It was not until recently that, while I was on my way to join the Belgians, a party had been sent to Emin and had climbed Kraepelin. I was then closely questioned as to my activities on Emin, and Count de Grünne was frankly unable to believe that I had been on a peak a few yards away from and a few feet lower than Kraepelin, with no intervening difficulty, and had yet forborne from completing the first ascent. He said that to the west of Kraepelin they had found a mark, not definitely a human footmark but yet unlikely to be anything else; and this I could not explain. However in spite of this I was invited into the camp and lent a tent and book, most appropriately named 'Mountain City.'

It was very kindly promised that on the morrow I should be shown the way that had been found up Mount Stanley from the west. I was unable to eat, and stayed in bed until early afternoon next day, when I set out with Count de Grünne. The way led round a spur jutting into the second of the three lakes, in the upper waters of the Kamusoso. To avoid a long detour a wonderful path had been constructed by Georges, the Swiss guide of the expedition, using porters acting under askaris supplied by the Congo Government. This was a hanging path of omukoni trunks supported by ropes from pitons driven into the face of the cliff. The way then skirted the first of the Kamusoso lakes, and a small rock-shelter was reached on the ridge between the headwaters of the Kamusoso and Luzilubu. The next morning Count de Grünne showed me the way that had been found by his expedition by the north-west ridge to the summit. This route is easier and shorter than that taken with slight variations by expeditions making the three previous ascents. On the crest of the north-west shoulder of Margherita a large stone-man had been erected to commemorate the first ascent of Margherita from the west.

It had been an uncomfortable climb for me as, besides having fever, both my boots had burst on the way up from Kalongi and the soles were tied on with string and my boots were full of snow. However these things were compensated for by the interest of the new route, and by the fact that now for the first time on Ruwenzori I stood on permanent snow with a clear sky. I was able to compare the amount of permanent snow now with that in 1926. As I had observed from the air, Alexandra peak, which had been snow-capped, was now

bare rock. The peak at the north end of Mount Speke had been entirely covered with snow except for a small circular patch of bare rock just below the summit on the west. It was for this reason that the peak had been known to us as Spot peak, or Ensonga. I remember that the representation of this rock on a photograph of Mount Speke had been removed by a professional photographer while making a composite negative. This peak was now bare rock.

Soon the clouds began to roll up the valleys, and we descended by the glacier flowing from between Margherita and Alexandra. At the foot of the glacier we found Georges, the Swiss guide, and another member of the expedition, waiting for Count de Grünne, and together they went off to another advanced camp. The return to the "Mountain City" seemed easy, but soon the mist became dense and ague came on violently, and it was several hours later that I literally staggered into camp and went straight to bed. The next morning I was quite unable to travel and had to ask permission to remain another day, which was readily granted by the Belgians remaining in the camp, from whom I received the greatest kindness. I now learnt something of the size of their expedition. They had used between sixty and seventy tents and had employed over five hundred porters. These had been most carefully looked after and they had had only three deaths. Those who were used for establishing the high camps were dressed in alpine boots, stockings, cord breeches, sweater with the initials of the title of the expedition woven thereon, waterproof caps and capes, and snow-goggles. After the day to recover from fever I made the return journey to Busaru. The detour to the Belgians' camp had taken twenty-three days, but I now knew that I could complete the traverse of Emin without upsetting the plans of their expedition, and I had the interest of a climb of Margherita from the west and a glimpse of an expedition run on a big scale.

During my absence my loads had been retrieved from the northern plateau and had mostly gone ahead, so, collecting the remnants of my porters, I returned to Kisomoro over the Bwamba pass. At the foot of the mountains, while labouring along in my burst boots, I was overtaken by F. D. West in a car and taken to his wonderful house at 6000 feet on a spur of Ruwenzori overlooking Toro. Here I rested and fed almost continuously for two days, but a few days later I still weighed 2 stone 5 lb. less than at the start of my expedition.

Expedition to Masawa: September 1932

Before starting on my last expedition to Ruwenzori I made a trip for collecting purposes to Mount Elgon, or Masawa, on the border of Uganda and Kenya Colony. This mountain is completely known and has recently been surveyed by G. M. Gibson of the Survey Department of the Uganda Civil Service. Like Kilimanjaro and Kenya, but unlike Ruwenzori, it is volcanic. There is no mountaineering to be done. The vegetation is similar to that of Ruwenzori, having the same floral zones. The more characteristic plants are of the same genus, though mostly different species: for example, the *podocarpus*, the tree *senecio*, the tall *lobelia*, the tree *hypericum*, and the many species of *rubus* and *impatiens*. There are however remarkable differences. On Ruwenzori such alpine vegetation as exists is to be found on the foothills and is entirely absent from the higher zones. On Masawa true alpine flora is found above the bamboo

Valley of Nyamgasani with sixth lake

The seventh Nyamgasani lake

zone. Masawa has a more varied flora and a number of conspicuous flowers which are absent from the higher levels of Ruwenzori, such as *kniphoffia*, *lathyrus*, *delphinium*, *anemone*, *scabiosa*, *dierama*, and *romulea*. Another difference is that in Ruwenzori is no sward; tall rank grass is found up to the forest, and above that only isolated tufts of grass. On Masawa, where rounded bluffs replace the knife-edge ridges of Ruwenzori, there are often large level areas with beautiful short turf.

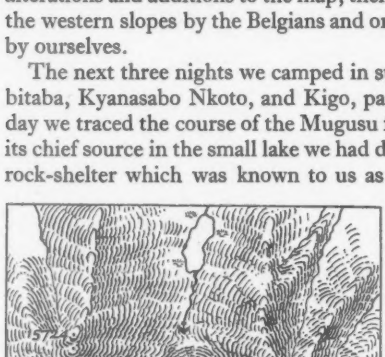
The population at the foot of Masawa is dense and the natives keep cattle which graze as far as the summit, and huts are found up to 13,000 feet, whereas on Ruwenzori habitation ceases shortly above 7000 feet. An effect of the Masawa natives being cattle people and therefore making economic use of the entire mountain is that the mixed forest and bamboo is gradually disappearing as the wood is being cut for fuel and for the construction of huts more quickly than it reproduces itself. Although gigantic podocarpus trees obtain in the mixed forest there is a remarkable absence of young trees, and in the highest zone the tree peucedanum, the easiest fuel to cut at that level, is almost absent except as quite young plants. There are enormous caves in Masawa, and these are used for human habitation and as shelter for cattle at night. Partitions are made in the caves so as to separate the quarters of different families from each other and from the space for the cattle. Such partitions are made of poles and wicker-work plastered with cattle dung. The floors of the caves are of cattle dung, in places many yards deep. In the higher regions where there are no caves, huts and cattle shelters are made of poles, wicker-work, and dung, the flat roofs being domed with plastered dung to make them waterproof. The scenery of Masawa is more attractive than that of Ruwenzori because of the more irregular contours, its bluffs, the areas of level sward, greater visibility, and the brighter flowers; Masawa must however yield to Ruwenzori in the interest of its historic associations and in the fact that it is still largely unexplored.

Seventh Ruwenzori Expedition: October 1932

My last expedition to Ruwenzori was intended to be short and had originally been planned for the sole purpose of collecting living plants to be taken back to England by air. I now however wished to complete the traverse of Mount Emin and to explore the valley of the Mugusu which we had reached in 1926 but which was otherwise unexplored. At Bugoye there was now a rest-house, built to replace the rest-house at Ibanda which had been burnt down. The site of Ibanda is now abandoned and Bugoye is the most convenient base for expeditions as the bridge over the Mobuku is now completed and Bugoye is at the end of a branch road running up the right bank of the Mobuku. At the last moment I was joined by Harry Tumner, a young South African resident in Toro. We reached Bugoye on October 5. Unfortunately there were no porters available, although on previous expeditions there had been an ample supply. The reason for this was that the circumcision festival was still in progress. We sent out runners to distant villages and I wrote a personal letter to the Mukuma, the native king of Toro, asking his assistance, to which I received a kind reply promising me by a certain date the number of porters I required, which promise was kept. By the 14th enough men had dribbled in and we were able to start with a few loads, leaving others to be sent on after us.

After a short safari we spent the first night at the camp of T. C. Jebson, who had hatcheries established on the bank of the Mobuku and was engaged on Government work, stocking the streams on the eastern slopes of Ruwenzori with trout. While engaged on this work he has been able to make many alterations and additions to the map, thereby supplementing the work done on the western slopes by the Belgians and on the northern and southern plateaux by ourselves.

The next three nights we camped in succession at the rock-shelters Nyinabitaba, Kyanasabo Nkoto, and Kigo, passing over known ground. The next day we traced the course of the Mugusu from its junction with the Mobuku to its chief source in the small lake we had discovered in 1926, and camped at the rock-shelter which was known to us as Wild-duck Rock-shelter (camp 53).



Drainage of lake between Mounts Emin and Gessi

While camp was being formed we explored the course of the river above the lake, tracing the course of two tributaries on its right bank. The following day we established a high camp and then sent the porters back to Wild-duck. We were unable in the mist to know where we were in relation to Umberto peak, and the next morning in exceptionally cold weather and with the rocks covered with ice and in a strong wind and powdery snow we made several attempts to find a way up in the direction we hoped would be that of Umberto, but were defeated by the mist and returned. We considered that we were south of the snow peak, and when porters arrived at noon we returned to Wild-duck.

The next day we followed up the main stream and then made several attempts to climb the cliff to the west in order to establish a high camp farther north. These attempts were made in heavy rain. It was not until late in the afternoon that we were able to find a way up the cliff and form a camp in the open at the limit of wood, it being too late in the day to make a camp nearer the snow. During the day we had traced the main stream of the Mugusu to its origin in a spring on the southern slope of the ridge at the head of the valley. This spring we had not seen in 1926, though we had assumed its existence owing to the size of the Mugusu a short way below the head of the valley. The bottom of the valley is choked with enormous boulders covered with a carpet of moss, and to avoid this while on our way to cross the Roccati pass we had travelled along the foot of Gessi, a little above the valley. While looking for a way up Emin on the present occasion we had again reached the top of the ridge at the head of the valley, and I was again struck by the unusual beauty of the lake as well as the curious topographical features. East and west were the almost sheer walls of Gessi and Emin; north and south of the lake were the two ridges joining the

mountains. The small continental basin was oblong in shape, and at the bottom of the depression was the elliptical lake, apparently of great depth. There was no sign of variation in the level of the lake, and it would appear that the waters feed the springs which are the sources of the Ruamuli and Mugusu.

Just below the second high camp, on the left bank of the river, was a rock shelter, more convenient than Wild-duck, and here most of the men camped. The next day, before and at dawn, there was a blizzard which covered the mountain and valley with fresh snow which remained all day. When the snow stopped falling Tumner and I went to the crest of the mountain and climbed a series of peaks in order to get a glimpse of Umberto, but were again thwarted by the mist. These climbs were the first that Tumner had made and it was the first time that he had trodden on snow. There was a strong wind and occasional snow and it froze all day. As the mist did not lift we returned to camp. No porter had brought up food or fuel from the valley, but there was fuel near the camp which we cut before it was dark. During the night it got more mild and there was heavy rain. Next morning some porters came up and, for the only time during this expedition, the sun came out. With the help of the porters we spread out clothing and blankets to dry. Before they were quite dry the sun went in and it began to rain, so suddenly that the blankets were wet again before we could pack them. In the rain we moved over a ridge to a camp farther north and much higher up the mountain.

Here was a large shelter known to us as Hexagonal-stone Rock-shelter (camp 56). It was dry and had a large opening looking down the valley on to the lake. It had however a small opening looking up to the ridge, and when the wind was from the east it blew through the shelter as through a funnel. By the time all the porters had reached Hexagonal-stone it began to snow. Most of the porters we sent hurriedly down to the valley, but two felt unequal to facing the snow and stayed with us, sharing our blankets. The next day the mist was so thick that climbing was hopeless. One porter came up with food and the three returned to the valley. The following day the mist was less dense and we climbed several peaks in the neighbourhood. Again we got no glimpse of Umberto, but it appeared that we were between that peak and Kraepelin. Returning to camp we found that two porters had brought up food to us, and these we sent back to the valley. The next day was again less misty and we started early and traversed northwards along the eastern slope of the mountain until we had got farther north than Okwetegereza, and then climbed up the main ridge. We were south of the difficult part of the traverse and followed the knife-edge ridge to Okwetegereza. The small cairn I had left had gone, but a few yards south of us, on the next peak, was a magnificent cairn. A few minutes' walk and a couple of hand-holds and we were beside it and on Kraepelin peak. From here we still could get no view of Umberto, so, following the crest of the mountain until we were above Hexagonal-stone, we climbed down to the camp, where we found a European companion.

A. L. Rusk and F. R. Jackaman had intended to join this expedition but were not free at the time we started. They reached Bugoye some days after we had left and at the same moment as the arrival of the porters sent by the Mukama. Following our tracks up the mountain they had reached Wild-duck the night before, and on this day Jackaman had stayed behind to look after the porters

and Rusk had come up to join us. Rusk was an experienced mountaineer but Jackaman was getting his first mountain experience. The next morning Rusk, Tumner, and I started to complete the traverse of Emin by climbing Umberto. The mist was thick and the day was cold and there was considerable delay before we found a way to that part of the mountain where we thought was Umberto. As yet I had seen no permanent snow on Emin, but by 1 o'clock we reached a precipice overlooking a glacier flowing from a mass showing dimly through the mist and which we took to be Umberto. With considerable difficulty, led by Rusk, we traversed along the rock wall until we reached the glacier. The rest was easy and Rusk waited while Tumner and I trudged up the uncrevassed glacier covered with fresh snow to the summit. The mist was so dense that it was not until we were a few feet away that we saw the stone-man built by the Italians and not since visited.

On returning to camp we found that Jackaman had arrived. The next day Tumner and I handed over stores and equipment and started our return journey. The weather had been exceptionally bad during our climbs. We saw the sun on only one occasion during the expedition and the temperature had been lower than on previous expeditions. Both Tumner and I had suffered from frost-bite. We spent the first night at the rock-shelter at the head of the Mugusu valley. This was the last of the fifty-seven camps we had used in the mountains, as on our return we stopped at camps already established. The next night, at Wild-duck, we noticed the work done by Jackaman. He had almost filled up the front of the shelter with a wind-proof wall of omukoni trunks and moss. In view of the exceptionally cold weather this must have made an enormous difference to the porters even if it did not actually save their lives. It is characteristic of the natives that, left to themselves, they would never have undertaken a piece of work of this kind even if their lives depended on it.

We returned to Bugoye by easy stages, collecting living plants on the way. On returning to Fort Portal I added to them the plants which I had sent or brought down on previous expeditions and which had been kept growing in boxes for me by Mr. and Mrs. Shillito of Nyakasura school in Toro, to whom I am much indebted for help in many ways.

It was not until long afterwards that I heard that Rusk and Jackaman had been beset by a continuance of exceptionally cold weather which had prevented them from doing much climbing. Three of the porters deserted and died of exposure on the way down. Jackaman, at the completion of the expedition, developed double pneumonia, from which he died.

Identification of legendary topographic features

As is widely known, the source of the Nile in great lakes fed by streams from a snow mountain was made known to the western world in about A.D. 150 by Ptolemy, whose maps show the main features of the Nile basin with remarkable accuracy. His "Mountain of the Moon whose snows feed the lakes, sources of the Nile" is accepted by most writers, including Stanley and the Duke of the Abruzzi, as being Ruwenzori, which corresponds in every respect with the description. It is a single massif; its streams flow into two of the great lakes, sources of the Nile; it is capped with the only permanent snow in the Nile

The eighth Nyamgasani lake

Mist rolling up Kurugutu valley, early morning

Cavern with spring, source of Ruamuli, fed by lake between Mounts Emin and Gessi

Lake between Mounts Emin and Gessi, looking north

basin, and it is roughly in the position defined by Ptolemy. Moreover the Sabaean Arabs, to whom the discovery is attributed, are believed from quite other evidence to have penetrated Africa as far as Lake Albert, whence Ruwenzori is visible.

In the classics are many allusions to the snow-fed sources of the Nile, but these may have been conjecture to account for the seasonal fluctuations of the river. Aristotle however, in about 350 B.C., refers to the origin of the Nile in the Silver Mountain, and this was considered by the Duke of the Abruzzi to be the earliest known reference to Ruwenzori. It may be remarked that both Aristotle and Ptolemy refer to a single mountain and that Ruwenzori is a distinct isolated mountain mass; also that to Arabs there would be a linguistic association between the idea of "Silver" and that of "The Moon."

About a hundred years before Aristotle, Herodotus, in 457 B.C., visiting Egypt, made repeated inquiries about the origin of the Nile. In one place only he found a legend as to its source. The Nile was said to rise from a spring fed by the waters of a bottomless lake between two sharp-pointed peaks, Crophi and Mophi, and that the lake fed another spring flowing south. It was added that King Psametichus had failed to make a sounding of the lake. The actual position assigned in the legend to the source of the Nile was north even of the southern limit of the Nile as then known. The diffidence with which the legend was offered, the scepticism with which it was received, and the fact that it was only found in one place, would seem to show that it was not due to any comparatively recent historic event such as an Egyptian expedition or an attempted sounding of the Nile. However although the position assigned to the source of the Nile was definitely wrong, and although the attempted sounding by Psametichus may be dismissed as an elaboration of the original legend, yet the topographic details which are the basis of the legend may indicate some very early geographic knowledge.

From Lake Albert the two northern mountains of Ruwenzori are visible. They are sharp pointed and remarkably similar in size, height, shape, and orientation. Snow mountains must have been a sufficiently interesting topographic feature to the Sabaeans, in whose country no such phenomenon existed, and it is difficult to believe that a race so enterprising as to penetrate so far into Africa at so early a date should have refrained from making inquiries from the natives or even sending an expedition to the mountains. Native paths run within 5 miles of the snow, and there is no technical difficulty in reaching the peaks and the lake between them. Native information, or such an expedition, would have disclosed the topography so exactly described in the legend discovered by Herodotus. If then we accept, what most writers accept, that Ruwenzori is the Moon-mountain of Ptolemy, it would seem that Emin and Gessi are the Crophi and Mophi of Herodotus, that the lake between them is his Abysmal lake, and that the source of the Ruamuli is the Fountain of the Nile of the ancients.

DISCUSSION

Before the paper the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: That great massif known as Ruwenzori, which is a somewhat perverted form of the name Ruwenjara, meaning "the rainy mountain"—and from all accounts

that name is well merited—extends for some 65 miles north and south, with a breadth of about 30 miles from east to west, and is a locality of great geographical interest. It consists of snow peaks and lakes, and much broken ground caused by, and the cause of, those distinctive features. It has attracted many travellers and explorers of different nations, as is shown by the names of the various peaks, which are Italian, Belgian, German, and British, though some of the native names have been allowed to remain as they were.

The Duke of the Abruzzi came in from the east and ascended more than one of the peaks which lie about halfway between the north and south ends of the plateaux, and there have been Belgian expeditions quite recently and at other times.

Dr. Humphreys, our lecturer this evening, has made considerable discovery and survey of the plateaux which lie to the north and to the south of the peaks, and, in doing so, he has added much to our geographical knowledge of the place. He carried out that work by a very proper use of the most modern means of reconnaissance, the aeroplane, and then made a more intimate survey on foot. After reading Science at Cambridge, Dr. Humphreys became a doctor. He has been in the Flying Corps and all his life has paid great attention to exploration. He was three years in Mexico on a botanical expedition, and during that time he made the first ascent of the highest peak of Popocatepetl.

Many will remember the excellent lecture which Dr. Humphreys gave to us on Ruwenzori in February 1927. He is going to take us to the same place to-day and will describe to us four separate pieces of exploration which he made there.

Dr. Humphreys then read the paper printed above, and a discussion followed.

The PRESIDENT: We have with us Sir William Gowers, who has recently been Governor of Uganda, and I will ask him to speak.

Sir WILLIAM GOWERS: My only qualification for speaking to you is that I have spent more time in Ruwenzori and have a greater affection for it than most of the present audience. During the four Christmases prior to the last one my camp, for as long a time as I could spare, was on the plains at the foot of Ruwenzori. I have never been able to climb it, as Dr. Humphreys has done, and only too rarely have I ever been able to see the snow peaks. I think you might like to know from Dr. Humphreys on how many days of the year he thinks it would be possible to obtain the marvellous photographs which he took from an aeroplane, and during how many hours on those days it could be done. My experience has been that of many other people; for instance, Emin lived for months within what is normally quite easy range of vision of Ruwenzori without ever being able to see the peaks.

When I first went to Uganda, Dr. Humphreys was a member of the Survey Department there. We were told that he was a Doctor of Medicine before that; at any rate, his knowledge seems to be quite encyclopaedic. After climbing Ruwenzori he decided that the rather pedestrian and terrestrial occupation of a surveyor did not offer him sufficient scope, so he then spent several years away from Uganda, perfecting his knowledge of medicine, and then he came out again and became attached to the Air Survey Company, who were then carrying out a survey of Lake Albert and the Nile, primarily for the benefit of the Egyptian Government, with a view to the construction of a dam across the Nile below Lake Albert. Finally, Dr. Humphreys became associated, I think, with the recent Belgian expedition which climbed Ruwenzori under the leadership of the Comte de Grünne, and which made for the first time ascents of the peaks from the Congo side and carried out very thorough studies and investigations of that side. Therefore his connection with Ruwenzori, both from below and from above, has

lasted for many years, and during the whole of the time he has been continually adding to our knowledge. I do not profess to be an expert critic of geographical work, but it strikes me that the exploration which the lecture showed us Dr. Humphreys had done among the peaks of Ruwenzori is a piece of really valuable geographical work. There are too few opportunities of doing such work in these days except in the case of explorations in the Arctic regions, and too few people who are ready to undergo the hardships which are inevitable. It is a remarkable fact that two of the principal and most interesting mountains in East Africa remained, after the first climb, for twenty years before they were climbed again. One is Mount Kenya, which was first climbed by Sir Halford Mackinder, and the other is Mount Ruwenzori, the highest peaks of which were first climbed by the Duke of the Abruzzi, who modestly, after christening the two highest peaks by the names of the Queen of Italy and the Queen of England, gave to a lower peak his own name, Luigi.

Now the Duke of the Abruzzi is a great sportsman and a great mountaineer, but I am sure he would be the first to say that his equipment was far more elaborate than that with which Dr. Humphreys accomplished the second climb, twenty years afterwards. The Duke of the Abruzzi could have done it, I am sure, if he had been in the same party as Dr. Humphreys, with the same equipment; but it did happen that he had an elaborate equipment. He had Alpine guides, I think, and long preparations were made for the expedition, whereas Dr. Humphreys and his two friends, who had nothing but the very simplest equipment, after a lapse of twenty years, during which nobody had got within some thousands of feet from the top, accomplished the ascent of the twin peaks. I have the very greatest admiration for that accomplishment, and I am very proud of its having been done by a member of the Government Service of which I was then the head. So modest was Dr. Humphreys that I did not have an opportunity of meeting him and telling him how highly I thought of his exploit until several years later, when he came back with the Air Survey Company.

I do not like to throw cold water on promising theories, but I must say that I am not wholly at one with Dr. Humphreys in his identification of the Mountains of the Moon with Ruwenzori. I have always held that the mountains which the early geographers described as the Mountains of the Moon were the very remarkable conical volcanic mountains in the Mfumbiso region. They have numerous lakes at their feet, and rivers rise from those lakes and flow in both directions, some of them flowing into the Nile waters and some flowing south. That however is only a personal opinion of mine, possibly without any good ground to support it, and certainly Dr. Humphreys's explanation of the twin cones and of the lake in the middle is most romantic and would be most convincing if one supposed that the early Arab or Egyptian explorers ever took the trouble to climb the mountains and discover them.

As I have said, the surroundings of Ruwenzori are a part of Africa for which I have the very greatest affection, and I hope one of these days to revisit them. It is quite easy to do it now, and I hope to persuade some of you to visit them. As Dr. Humphreys knows, recently in Uganda we have made roads which have enabled the foot of the mountains, at any rate in the valley which is the most usual route for the ascent of the mountains, to be quite accessible within a very short time. As a further attraction for tourists and geographers, two years ago I caused trout to be placed in the Mobuku river, so that fly fishing as well as mountaineering can be carried on.

Dr. Humphreys has talked of Ruwenzori from the outside and from the top, but the inside may prove even more important than the outside. It contains, as we know, some of the richest copper ore in the whole of the world, and the

extent of that is not known. We know it is very large, but we do not know how large it may be. That copper, if there turns out to be an important mine there, will have the shortest rail transport to the sea of any copper deposits in Africa, and one of these days Ruwenzori may prove to be an enormous mineral area and may have large mining towns at its foot. I think no one need be afraid of that prospect, for a vast natural feature like Ruwenzori cannot be spoiled or defaced by any of man's puny efforts.

I have nothing more to say at the moment except to express my own intense interest in and admiration of the wonderful photographs we have seen, and again to pay a tribute to the pluck, perseverance, resource, and accuracy of Dr. Humphreys. He was for a long time a professional surveyor, and, as all surveyors must be, he is the quintessence of accuracy in his observations.

The PRESIDENT: The first thing I must do is to thank Sir William Gowers for supplying this information for fishermen. A friend of mine, when he saw pictures of the lakes, murmured in my ear: "Are there trout there?" We know now that there are some there. Whether there are any other fish there I do not know. Dr. Humphreys tells me there are not.

If any of you want to settle that question as to which are the Mountains of the Moon, there are a great many maps that you will find in this building, some of them open in the Museum now, where you can go and see where the Mountains of the Moon have been placed. You may not however find them placed with sufficient accuracy to decide which theory is right.

Dr. Humphreys has given us an evening of very varied interest—the flying, the climbing, the geography, the flowers, and so forth—and I should like to emphasize what Sir William Gowers has already mentioned, namely, the persistence and care which Dr. Humphreys showed in noting and then describing this evening what he saw and what he found. I do not know whether he intends to write a book about his journeys in Ruwenzori, but, if he does, I can assure him that to many of us it would be of very great interest. When we remember the various matters on which Dr. Humphreys has spoken, we may be quite sure that an elaboration of them would be very interesting. I would refer to the use Dr. Humphreys made of aeroplanes for reconnaissance and the way in which he then followed that up on foot. It is a matter of importance that those two methods should be co-ordinated. The lecture, when it is printed in our *Journal*, will contain maps which will show very clearly to those who are interested in this particular part of the world fresh physical features of all kinds.

There is one thing for which we thank Dr. Humphreys particularly, and that is that he undertook to lecture to us to-night at very short notice. Major Bagnold was to have lectured to-night, but he was forced by his duties to take up his appointment in China, and Dr. Humphreys took his place at really quite short notice. Will you, Dr. Humphreys, accept the very sincere thanks of this audience and of the Society for the admirable work which you have done in these expeditions, for the charming and, may I say, most modest way in which you have described your work, and for the very beautiful pictures which you have shown us both of the mountains and of the flowers of Ruwenzori? We ask you to accept our sincere thanks and we look forward to seeing your lecture published in the *Journal*.

CHANGES IN LAND UTILIZATION IN THE SOUTH-WEST OF THE LONDON BASIN, 1840–1932

E. C. WILLATTS

THE Land Utilization Survey has set out to record how the surface of the country is being used at the present time, and the information, obtained by volunteer workers and recorded on the six-inch maps of the Ordnance Survey is being made available for study through its publication (by the Ordnance Survey) in the form of one-inch Land Utilization maps, giving in colours over the ordinary map a precise picture of the landscape pattern. This article is an attempt to consider one aspect of the work, that of the value of the present record for purposes of comparison with conditions at other periods. Those who, in the future, wish to examine the changes which will have taken place between our period and theirs, will have our record available for consultation. They will be able to see exactly where changes have taken place, and with the material at their disposal will be able to assess accurately the factors which have influenced and controlled changes in some areas, or which have resulted in a stability of conditions in others.

We, who examine the cultural landscape of the present day, the state which is always about to change itself into the future, are less fortunate when we wish to look backwards in order, by examining the past, to understand more fully how the present landscape has been evolved, since we have no easily accessible records of land utilization in the past. There are some, of course, such as William the Conqueror's Survey, and the manorial maps, but the former is of little use since it was not recorded in map form, while the latter are often difficult to reproduce on a scale which would make them comparable with current maps, and moreover they were not made in large numbers at any one particular period. There are several valuable surveys at later dates, such as Rocqué's, but they are not of widespread occurrence. Our best data for the past exist in a survey made nearly a century ago for the purpose of tithe commutation. The survey was made on a parish basis, a plan being made, with each plot of ground numbered and a schedule drawn up, which gives, among other particulars, the utilization of each field. The greater part of the data relates to the period 1839–40–41, and by examining the records it has been possible to construct land utilization maps of certain parishes for that period. The Ministry of Agriculture, in whose possession the records are kept, has been good enough to allow access to the documents for this purpose.

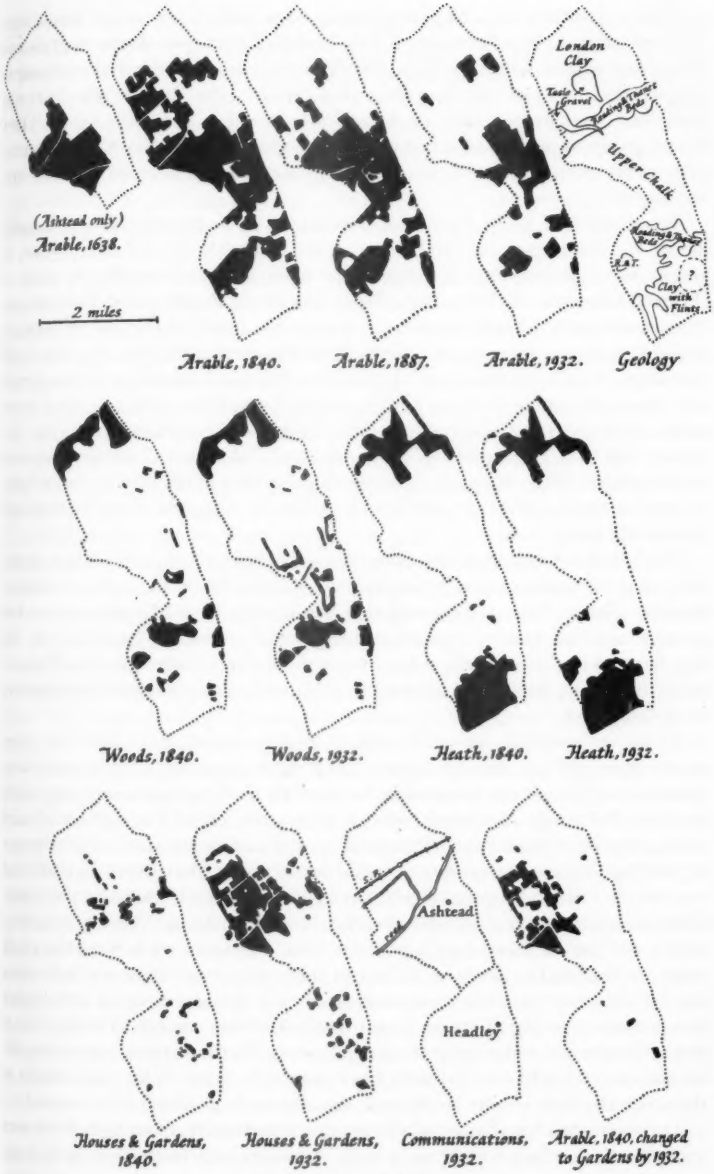
The procedure which has been adopted has been to choose certain parishes in the area to the south-west of London, and to make for them a one-inch Land Utilization map for the period about 1840, which is strictly comparable with the published one-inch Land Utilization map of the Windsor area (sheet 114). To ensure accuracy, the tithe maps have first been reduced to the six-inch scale, the scale on which the field work of the present survey has been carried out, and then reduced to the one-inch scale. In some areas it was necessary to use the first as well as the second editions of the six-inch sheets in order to identify former fields, so great have been the changes in the landscape. In other more rural areas the arrangement of the fields, etc., has remained much the same,

although their utilization may have altered. Even if time permitted, it would not be possible, at least in such an area as this, to reconstruct the whole of the map, since for some parishes there are no tithe maps; while in others considerable portions were free from tithe, and consequently no records were compiled for them; so the method of sampling has been adopted. Ten parishes have been chosen, in four groups which are representative of different parts of the area and of the various types of changes which have occurred in them. Within the scope of a short article it will only be possible to show a few typical maps illustrating the changes which have taken place, and to mention some of the factors at work. While far from being comprehensive, this should at least serve to illustrate the possibilities of this type of investigation.

The two parishes of Ashtead and Headley (Fig. 1) occupy a typical section from the top of the chalk downs, here covered with clay-with-flints and pliocene gravels, at about 500–600 feet, with a large open expanse of chalk on the slope, dipping to the low London Clay lands at the foot, with a narrow outcrop of Thanet and Reading beds.

It has fortunately been possible to obtain the requisite data for both of these parishes for 1887 as well as 1840, and in addition a manorial map of Ashtead of 1638 is available. Of this map the three open common fields have been shown. It is not possible, within the scope of this article, to mention many of the interesting facts which the manorial map reveals, but an important fact is that in 1638 only the best soils, the chalk loams, were cultivated. The heavy clay lands which were brought under cultivation later were then either marsh or pasture, and even some of the chalk soils later ploughed were given over to sheep walks in 1638. The other three maps reveal a striking change within the century. In 1840 an extremely high proportion of the chalk was cultivated—63 per cent. of both parishes. Much of Headley lies at a considerable height, and some of the slopes are rather steep, but in Ashtead, at a lower altitude, 82 per cent. of the chalk was cultivated. Until 1887 there was little change on the chalk, 59 per cent. of the whole and 73 per cent. of Ashtead remaining under the plough. In Ashtead there was some decrease because of building, but in Headley there had been a slight increase. The greatest change has taken place in the last forty-five years, when the cultivation on the chalk has shrunk to nearly half of that of a century ago—32 per cent. as against 63 per cent. Some of the chalk soils are of a marginal nature for cultivation. An area at Headley at about 500 feet, capping a rise in the chalk, was cultivated nearly a century ago. In 1887 it was under grass, later it came under the plough until a few years ago, when it was laid down to grass, but in the last year a part of it which is fairly well sheltered by a belt of wood has been fenced off and reploughed.

The London Clay belt shows a marked contrast to the chalk. Much of it is very poor soil, and has always been left unenclosed as heath or forest, but nearer the village of Ashtead are a large number of fields which, marked as marsh or pasture on the manorial map of 1638, were largely cultivated a century ago. Considering the great extent of heath and wood on the clay, the proportion of 32 per cent. of the whole which was cultivated in 1840 is surprisingly high. This was in the part which is better drained, and where the soil has been lightened by washes of gravel.



Ashtead and Headley

Fig. 1

This cultivation was in a period when crops such as wheat and beans were more profitable; by 1887 most of this land had been put down to grass and had either passed into the hands of builders or was in use for dairy farming to supply the needs of an increasing population. Less than 8 per cent. was therefore cultivated by 1887, and the figure to-day is about the same. There is one group of fields which had changed to grass by 1887 but has since come into cultivation again, and is now being used for such crops as roots and cabbages.

Woodland and heath, two categories which in many parts of the London Basin are complementary and often interchangeable in character, show, as might be expected, little change. The main areas of woodland, parts of Ashtead Common, and the steep-sloped outliers of Reading and Thanet beds, remain the same. There have been one or two small clearances for pasture, and one instance of a steep arable field on the Reading beds, adjacent to old woodland, which has been converted to wood as hazel coppice with standards; but the main change has been an increase in the number of shaws, the narrow strips of mixed woodland bordering the fields, which occupy little space, but greatly alter the appearance of the landscape, and whose chief function is to shelter game. This change is an interesting instance of the way the rural landscape has been altered to cater for the sporting demands of an increasingly residential area.

Heathland remains much the same; the heavy ill-drained parts of the London Clay, and the poor sandy soil (mainly pliocene gravels) on the high wind-swept Headley Heath. (It may be mentioned that it is the land adjacent to these two areas which has seen the greatest change from arable to pasture.) On the higher parts of the chalk there have been some interesting increases of heathland, due to the land being allowed to go out of cultivation without a pasture being prepared.

There are probably several factors at work in such cases. The very steep slopes were not too difficult to use when most agricultural operations were manual, but are almost impossible to use with modern machinery, especially binders. Relatively increased costs of tillage tended to the neglect of such fields, or parts of fields, and in times of agricultural depression, when the cost of seeding to grass, always heavy, could least be met, they were often allowed to revert to a natural vegetation without any attempt at enclosure for pasturage. This tendency to abandonment towards the end of the last century coincided with a decline in sheep farming in the area, and since such waterless chalk areas are unsuited to cattle, in default of sheep pasturage there was little other use for the land. In some cases such areas have become covered with bushes in a surface covering of coarse grass; in another case a scrub growth of birch and sycamore is colonizing from an adjacent wood; the steepest parts naturally become more easily covered with trees than with grass. The exact nature of the scrub depends chiefly on the tree association from which it has seeded.

The most striking change of all has, not unnaturally, been that of the area occupied by gardens which, on a map, shows human settlement in its most accurate sense. In this respect the two villages stand in marked contrast. Headley—a downland village mostly over 500 feet, lies off the main road to-day, as it lay off the Roman Road of Ermyn Street, and it has changed but little.

Ashtead lay on the main Epsom–Leatherhead road, one of a chain of spring-line villages at the foot of the downs, a coaching point at the eighteenth milestone from Cornhill. When the railway followed the road it developed rapidly, from a few houses along the road, and the edge of the common with a few big mansions standing in their own grounds, to a well-developed residential village, at first rather as a country retiring place, but with the electrification of the line and improved train services, also as a place of residence for workers in London. The last map shows the considerable extent to which new building has taken place on land which was formerly cultivated.

The two parishes of White Waltham and Shottesbrooke (Fig. 2), rather remarkably interlocked, lie in the north-west part of the area, stretching southward from the Bath Road near Maidenhead Thicket, in an area which has remained an almost undisturbed rural one throughout the period. There are three geological outcrops, Chalk, Reading Beds, and London Clay, so that, in some slight measure, these parishes are the counterpart in the north-west of the London basin of Ashtead and Headley in the south. The higher beds of the Upper Chalk which occur here are ideal for agriculture. The rock is overlain with a shallow covering of clay-with-flints, forming a fairly heavy loam over most of the area. In a few parts which are sandier, there is a lighter, drier soil, and such areas were either taken up for settlement and grass in 1840, or have since changed to grass. In 1840 over 81 per cent. of the chalk was under cultivation, and except for two parks there was hardly any grass, save a few meadows around the farms. To-day the proportion has only dropped to 51 per cent. When it is remembered that on the whole it has become increasingly difficult to grow ordinary crops in Britain to compete with imported foodstuffs, and that, especially near large centres of population, there has been a strong economic urge favouring dairy farming, the persistence of arable farming on these chalk soils has been remarkably good. High yields are obtained, and the area is a prosperous agricultural one. The century has seen a significant change in the size of the fields, modern agricultural machinery on fairly easily worked land demands larger fields for economy of working, and in consequence the rather unnecessary hedges have been inclined to disappear, a tendency which is still at work, and which is a good sign of confidence in the future maintenance of the arable nature of the farming.

The Reading Beds are of sands and clays, underlying the London Clay, and inspection in the field shows that the soils of this series have been extended much farther to the south over the London Clay than is indicated by the geological map. This of course does not take account of deposits shallower than 3 feet, but which here, as often elsewhere, completely alter the character of the soils; and in this area the London Clay is not reflected in the soil until about a mile farther south than its plotted boundary. The sandy clay, neither too stiff nor too dry for tillage, has not been extensively cultivated because of the competition for other uses, but the London Clay was quite extensively under the plough, and this is the area which has seen the greatest change. In 1840, before the repeal of the Corn Laws, practically the whole was under cultivation, in the small rectangular fields which are so typical of enclosed areas of London Clay, and now, in the true clay area, there are only three small fields cultivated.

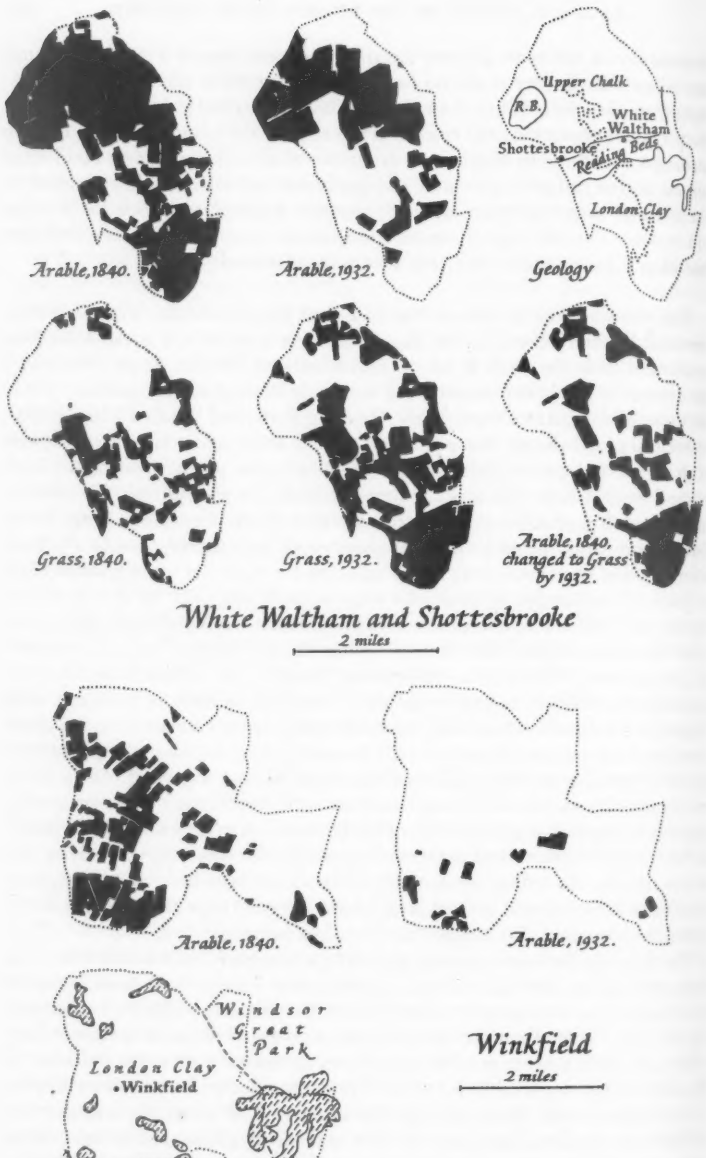

Arable, 1840.
Arable, 1932.
Upper Chalk
R.B.
White Waltham
Shottesbrooke
Reading Beds
London Clay
Geology
Grass, 1840.
Grass, 1932.
Arable, 1840, changed to Grass by 1932.
White Waltham and Shottesbrooke
2 miles
Arable, 1840.
Arable, 1932.
Windsor Great Park
London Clay
Winkfield
Bagshot Sands & Plateau Gravel
Geology
Winkfield
2 miles

Fig. 2

The maps of grassland at the two dates supplement those of the arable areas to complete the agricultural story, while the actual areas which have changed to grass are shown in a third map. There was very little grass on the chalk, but there has been some increase, especially on one or two patches of lighter soil. With an increase in dairying, there has been a tendency to lay to grass some of the land nearest the farmsteads, and it is only where, in doing this, a large field has been subdivided, that there has been any exception to the tendency to enlarge the size of the fields. The Reading Beds give an ideal soil for grass and for gardens, so that, apart from the spring-line reason for their location here, the villages have developed in this belt, which was favoured by the large parks around gentlemen's houses. With the tendency for mixed farming the proportion of grass has increased. The reasons for the very striking increase in grass on the London Clay have been mentioned; shown graphically the change is very eloquent. It need hardly be pointed out that while the clay is at present best kept under grass, the grass that it supports is not so good as that on the soils which are more profitable for agriculture, such as the loams of the Chalk and Reading Beds. Moreover, new pastures are never so good as old; it takes many years to make a good pasture, and apart from this, our farmers are not remarkable for their skill at grassland management. Our agriculture is traditionally an arable one, and our farmers second to none in their craftsmanship of cultivation, but it is the exception rather than the rule to find the same care bestowed on pastures as on cultivated fields.

The northern part of the village of Winkfield, shown in Fig. 2, is one of the best examples of the London Clay outcrop and its utilization. The heavy soil in this area does not invite modern housing development, but it is an area favoured by large parks, surrounding large mansions, situated here partly because of the vicinity of Windsor Castle, itself in the Great Park, and partly because of the suitability of the region for this type of development. The south part includes the north edge of the Bagshot Beds, together with some patches of Plateau Gravel. The main area is of the very heavy London Clay, a stiff soil, very difficult to work, and usually reckoned at least "three-horse land."

In 1840 grassland predominated on the clay, and a considerable portion, especially within the Great Park, was, and still is, under woodland. However there was quite a considerable amount cultivated outside the area of the Great Park: as much as 27 per cent. of the clay outcrop, a very high proportion when it is remembered that it included several very large private parks. To-day practically the whole is under grass, less than 5 per cent. is cultivated: a figure which is sufficiently eloquent to make comment superfluous except to recall the similarity of the figures for Ashtead, 32 per cent. and 8 per cent., as against 27 per cent. and 5 per cent. here. Inspection on the ground, or even with the aid of the new "Relief Edition" one-inch map, shows that all the fields now cultivated in the area are on a fairly good slope, so that water does not accumulate and hinder farming operations, while soil wash is easier. Most too are either on the margin of the sands and gravels, or on the down-slope below such deposits, where the soil has been to some degree lightened. The heaviest fields, naturally, have been those longest laid down to grass. Actually a detailed inspection on the ground will show that, even at the period of maximum

cultivation, it was the fields situated on slight slopes between streams which were cultivated, while those where natural drainage was not so good were left to grass. Field shapes and sizes, as in the clay area of White Waltham and Shottesbrooke, have altered but little; they are small, and, except where the drainage requires them to take curved shapes, rectangular. The area is now essentially a dairy farming one, and it is noteworthy that the only new farmstead erected since 1840 is called "Dairy Farm."

The large group of five parishes shown in Figs. 3 and 4 is well placed to give both a representative sample of different soil types, and changes consequent on these, and to give typical examples of the changes which have been due to human, rather than to agricultural factors. The group is at the junction of four countries: Bucks, Berks, Middlesex, and Surrey, and is situated 15 to 20 miles out of London between the Bath Road at Colnbrook and the main south-west road out of London through Staines to Bagshot and Basingstoke. Both by rail and road they cluster at an important focal crossing point of the Thames at Staines, below the confluence of the Colne.

The Colne Valley, in which flow three distributaries, is well over a mile wide, and breaks up the gravel plain of the Thames which is here very flat and level, the extreme levels being no more than 46 and 76 feet. In contrast, the Bagshot plateau rises sharply at Egham to about 200 feet, and presents a very different type of landscape, fairly well wooded, with unenclosed heathland in the south at Chobham Common, and considerable areas devoted to large parks and estates.

The maps of human settlement are placed first in Fig. 3, because in this area it is the increase in population which has of itself most largely altered the appearance of the landscape, and has moreover greatly influenced the use made of the land which has not been built over. The pattern of housing development in the area is very typical of that in many parts of the London Basin. In 1840, while the two small towns of Egham and Staines are clearly distinguishable, the general arrangement is that of small nucleated settlements on the Thames Gravels, where in an area of good water supply the population was distributed on the roads in hamlets according to the needs of farm work. On the Bagshot plateau the settlement was much more scattered, although actually the same proportion of the land was taken up as on the gravels: 6 per cent. on each case. The reason for the scattered type is chiefly the smaller size of holdings, and the extent to which the population served the large houses situated on the edge of Windsor Great Park.

To-day the area is within half an hour of London, and being well suited to settlement has been adapted accordingly. By 1932 over one-fifth of the whole area was occupied by houses and gardens, more even than is used for arable land. Ashford, the parish nearest London, has been most extensively built over, with middle- and lower-class houses, mainly developed on estates working back from the main roads, whose shape has followed that of the fields in which they were laid out. The village now merges with Staines and Egham in one almost continuous urban development. The banks of the Thames, except where preserved at Runnymede, have been almost entirely built over, mainly with bungalows liable to periodic flooding. The area not served by the railway,

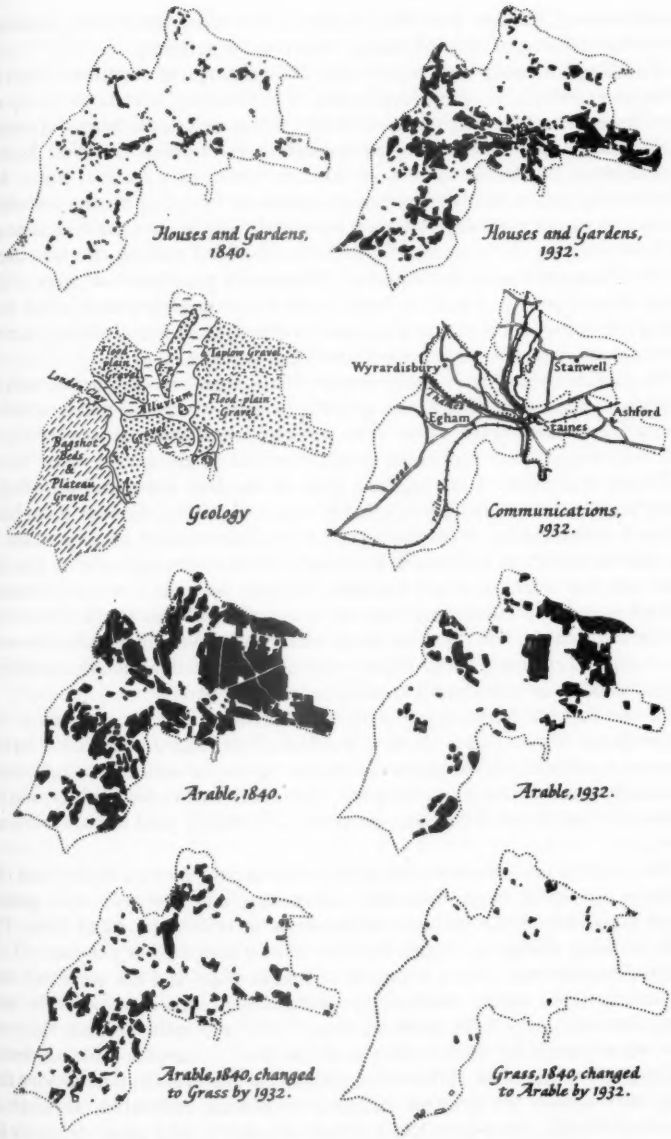

Houses and Gardens, 1840.
Houses and Gardens, 1932.
London Clay
Flood-plain Gravel
Taplow Gravel
Alluvium
Bagshot Beds & Plateau Gravel
Geology
Wyrardisbury
Stanwell
Egham
Staines
Ashford
canal
railway
Communications, 1932.
Arable, 1840.
Arable, 1932.
Arable, 1840, changed to Grass by 1932.
Grass, 1840, changed to Arable by 1932.
Ashford, Egham, Staines, Stanwell and Wyrardisbury.
4 miles

Fig. 3

as at Stanwell, has seen but little change; a few more houses, but essentially the same settlement, and still mainly interested in farming.

The Bagshot sands have seen a very different type of settlement from the Thames gravel plain. Many large parks of last century have been cut up and used for expensive modern houses whose owners seek in the beautiful country the seclusion and outdoor recreation (such as golf) which the West End no longer gives, but at the same time they are within easy reach of town. It is noteworthy that in the best instances instead of following on the unsuitable lines of an earlier rural development, an entirely new lay-out has been arranged without scarring the countryside, with the object of making the best use of views of beautiful unspoiled country. This is only possible on so large a scale in an area of poor soil such as here, a soil whose poverty has resulted in its being left to support the natural vegetation which, in such undulating country, provides an attractive setting for better-class housing.

The arable area of 1840 shows a remarkable degree of correlation with the geological map. On the Thames gravels, in spite of several parks, which of course were under grass, as much as 74 per cent. of the area was cultivated, and only 10 per cent. was under grass. The soil on the gravel varies from a stiff loam near the river to a medium loam on the drier parts, and the whole is fairly easily worked land, and probably was, and still is, the best ploughland in the London Basin. It may seem surprising that as much as 20 per cent. of the alluvial land was cultivated, but careful field observation shows that this land was that which was not regularly flooded; or what is more important, though nearly the same thing, that on which the soil was above the average winter water-table. On the other hand, where the gravels or the alluvium were low-lying and regularly flooded, they were not cultivated, although a good deal of that which was cultivated was liable to irregular floods.

Of the Bagshot Beds 29 per cent. was cultivated, exactly as much as was under grass. The soil is poor, dry, and lacks lime, and it needs considerable manuring to bind it and increase capillarity. At the same time it is light, early, and easily worked, and when there was a fair local market for produce, and the ground in less demand for other purposes, it certainly paid to cultivate some of it.

The map of present-day cultivation makes a poor picture beside that of a century ago, even when nurseries, allotments, and orchards with ground crops are added to the ordinary arable areas, as is done by ruled lines. The most striking change is on the Bagshot soils, where only 8 per cent. of the outcrop is cultivated (about a quarter of that in 1840) and the areas still used are mostly those where local gravel washes have given a rather stiffer soil. Unquestionably, the light lands are less profitable to cultivate, but there are also other reasons for their neglect as arable land: competition for residential and recreative purposes. When we consider the gravel soils, it is obvious that they have shown the greatest tendency to remain cultivated, although as mentioned below, they have had to contend severely with other demands for their use. As can be seen by comparison with the map of Houses and Gardens, it is obvious that where, as in Stanwell and parts of Wyrardisbury, the builder has not yet waged his campaign, a high proportion of land is still cultivated; of the whole of the gravel area 31 per cent. is still under the plough; this does

not seem a high figure, unless it is realized that only 52 per cent. of the area is being used for farming operations. The reason is that these soils, neither too heavy nor too light, are among the best, and have, especially in Middlesex, been largely used for market gardening. There is actually some quite good market gardening on the alluvial soils in the Colne Valley, where they are well drained. There is no doubt that market gardening is very profitable, and has retarded conversion to grassland, but even where it is not practised, as on most of the Bucks side of the Colne, ordinary crops are grown with great success. The Bagshot sands have suffered the greatest change, being on the whole too light to remain profitable in times of depression.

The map showing areas changed from arable to grass tells the agricultural story more truthfully than does a comparison of the two maps of arable areas. Over the whole area 28 per cent. of the land which was arable in 1840 has changed to grass, but on the gravel plain it is only 15 per cent., on the alluvium 47 per cent., and on the Bagshot soils 65 per cent. Not merely have the Bagshot soils seen a change from arable to grass, but in several cases (shown in outline on the map) to woodland or heathland. The change from arable to grass on the alluvium is principally due to the desire of dairy farmers to have pastures adjacent to water, and the alluvial fields were generally favourably placed for this. This factor is important too on the gravel soils near the rivers, where in recent years land has been laid down to grass because of the increase in dairy farming, land which is in no way inferior to that which is retained under the plough. The reason for its conversion in such cases has been one of convenience in the arrangements of the fields, two factors being considered: access to a stream for watering cattle, and easy access to the farmsteads, so that the animals may be moved to and from grass between milkings.

There has been no general tendency for the gravel soils to be laid to grass, and quite a number of fields in the area have changed from arable to grass, then back to arable, and sometimes back to grass again within the period, the reason being more the whim or desire of the particular farmer than any reason of greater suitability for one utilization or another. A very large tract was laid to grass in the Colne Valley, because it was required for a large rifle range about forty years ago, and since the range was dismantled after the war, some of the land has been reploughed. Quite a few of the areas shown as having changed to grass are under grass for non-agricultural purposes, as sports grounds or golf courses, to serve the needs of an increasing urban population.

The map of areas which have changed from grass to arable does not show much, but the surprising thing is that there is any such land to show. All the land which has changed from grass to arable is on the gravels, and there are two reasons for the change. One is drainage: several areas have been protected from floods by a Thames flood bank, but the more important reason is the extension of market gardening, so that a few fields formerly under grass for cattle have had their hedges removed and been taken in for this most profitable form of farming. The three areas shown in outline, on the Bagshot soils, are calculated to give a shock to any simple generalization, for they are areas which in the century have changed from heathland to arable, and if any should doubt this, the actual process of breaking up the virgin heath may be seen proceeding on one farm on the north edge of the Bagshot Common at the present

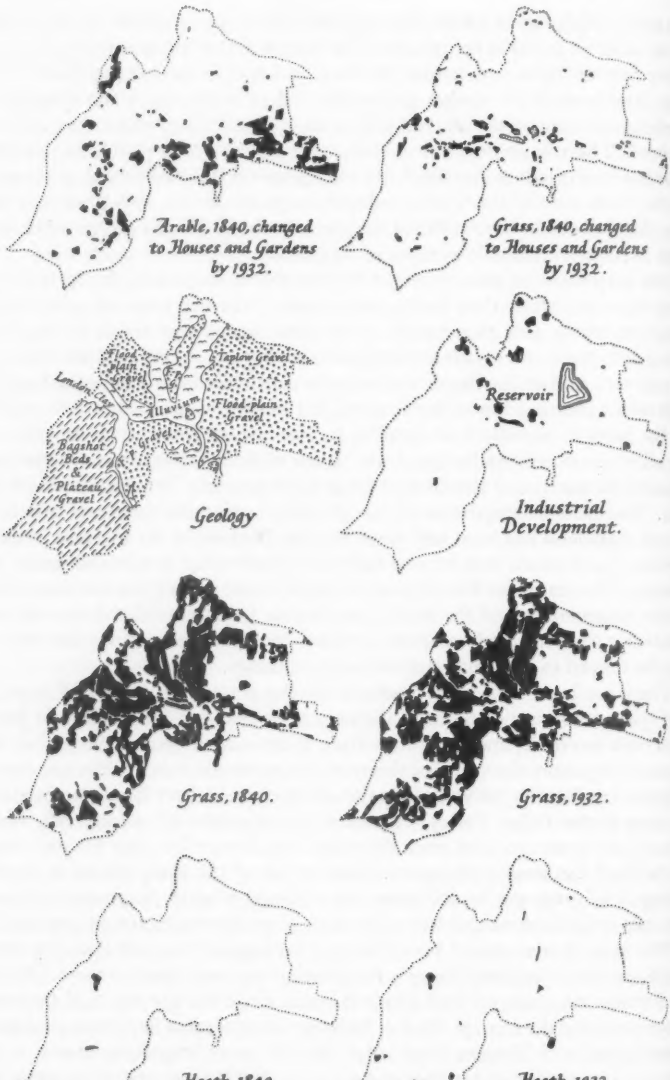

Arable, 1840, changed to Houses and Gardens by 1932.
Grass, 1840, changed to Houses and Gardens by 1932.
Taplow Gravel
Flood-plain Gravel
Alluvium
London Clay
Bagshot Beds & Plateau Gravel
Geology
Reservoir
Industrial Development.
Grass, 1840.
Grass, 1932.
Heath, 1840.
Heath, 1932.
Ashford, Egham, Staines, Stanwell and Wyrardisbury.
4 miles

Fig. 4.

time. There is at least one farmer who is an optimist, and he appears to be making his cultivation pay.

The map of "Industrial Development" (Fig. 4) shows something of another change which has been taking place in this part of the London Basin. It is yet too far from London to have been affected considerably by the spread of factories, which in the south-west have mainly developed either close to London in densely settled areas, or along the line of the Great Western Railway where it follows the Grand Junction Canal. In addition to the local gas, water, and electricity works, there has been a little factory development beside the Thames, largely because of the convenience of the water front for the transport and intake of raw materials. A very considerable area of land, formerly almost entirely cultivated, is taken up by the Staines Reservoir, the second largest in the London Basin. It is a great pity that inferior land cannot be used for developments of this character, but it is impossible; level land with gravel or other soil underlain by clay is essential, and so the inferior Bagshot country escapes such developments which are crowded on to the valuable gravel soils, already in great demand for non-agricultural purposes. Among these may be considered the large gravel pits which in the last decade have become an important feature of the Thames plain. The gravel is of an excellent quality for building material, and extends to a depth of 25 to 35 feet above the clay, and the demand for the material, combined with the facilities for modern road transport to nearby markets, have led to its extensive exploitation. Most workings employ electrically operated suction pipes, which remove the whole thickness of gravel, and as this is mainly below water-level, large and ever-growing lakes result.

The greatest loss of agricultural land has been that which has been taken for housing development, and two maps in Fig. 4 show the respective amounts taken from arable land and grassland during the last century for this purpose. Land taken for factory development has been indicated by a stipple. As might be expected, arable has suffered more than grass from housing development. On the whole, granted accessibility and water supply, both of which present no difficulty in the whole of the area, arable land is to be preferred to grassland for housing development, since it is generally drier and better drained, as well as being easier for the householder to cultivate. This is true even on the Bagshot soils, which, being lighter and drier, might be expected to show little difference in this respect. Actually they have had more arable land taken for gardens than has remained under the plough; nearly twice as much arable land as grassland has been used, 32 per cent. of the former arable, and 17 per cent. of the former grassland. On the gravels where, as previously shown, almost all the best land was cultivated, some 17 per cent. of the arable and only 3 per cent. of the grass has been used for housing. Nearly 18 per cent. of the alluvial grassland has been taken for housing; this is mainly for Thames-side bungalows.

The maps of grassland at the two dates are, all things considered, remarkably similar, especially when the outstanding changes in the arable area are considered. There has of course been an increase of grass, but only from 27 per cent. to 33 per cent. of the whole area, as contrasted with a decrease in

arable from 47 per cent. to 18 per cent. Most of the reasons for change in grassland have already been mentioned, the increase in dairy farming and in sports grounds on the gravels, which have about twice as much grass now as in 1840, but still more arable than grass (20 per cent. grass and 31 per cent. arable), and the conversion of grassland on the Bagshot series, because of the generally unprofitable nature of the soil for tillage. It is quite clear that in this group of parishes the grassland has not gained what the arable has lost, whereas in areas where the agricultural factor has been practically the only one at work, this has been the case.

Heath and rough grazings, while occupying a comparatively small area, have shown some change. There are several small areas which, by being cut off between a railway and river, or between three railway lines, or by the making of a new cut for the river, as at Penton Hook, have become inaccessible from the farms to which they formerly belonged, and being allowed to run to waste, have developed a heath-like vegetation. On the Bagshot sands near the edge of Chobham Common, there are several changes: decreases due to bringing land under cultivation as already mentioned, and to housing on the heathland, and increases where land formerly farmed has been neglected. Although this area is now a golf course, it had already reverted from arable and meadowland to heath before it was laid out for golf, and in fact, a farmstead which stood here a century ago had completely disappeared before the war.

It would probably be premature to attempt to formulate any broad conclusions from the little work which has been done, but sufficient should have been shown to demonstrate the possibilities of this type of investigation. Pursued further, and studied in connection with the parish statistics of crops and livestock of the Ministry of Agriculture, it should help us considerably in many directions, especially in our endeavours to evaluate correctly the various factors which have been at work influencing agricultural geography.

THE AGRARIAN CONTRIBUTION TO SURVEYING IN ENGLAND

H. C. DARBY

THE revolution in surveying which took place in the century from 1550 to 1650 was associated with three contemporary developments: an increasing interest in navigation with its accompanying application of astronomical theory; progress in the military sciences coupled with the application of geometry to the problems of sighting, etc., in gunnery, and the employment of gunsmiths in the making of experimental instruments; and, thirdly, the agrarian changes of the period together with the improved methods of farming which they involved. The purpose of this paper is to indicate the contribution of the third factor, and to stress the essentially agrarian background of the cartographical advance of the sixteenth and seventeenth centuries.

The agricultural changes that were taking place from the latter part of the fifteenth on to the middle of the seventeenth century constituted a watershed in English economic history. Implicit in these changes was the disintegration of the open-field system of farming in common, and its replacement by a more individual occupation and management of land. One of the main innovations was summed up by the men of the time under the word "enclosing." This term, although it raises difficulties, does describe a prominent external feature of the time. For emancipation from the rules of communal cultivation took, in some cases, the form of a rearrangement by the small cultivator of the open-field strips into compact fields and closes, while in other cases it was apparent as the consolidation of small holdings into great estates by the landed proprietors; and sometimes it meant the reclamation of land from the waste. All processes were symptomatic of an effort to adapt farming practice to the needs of a new economic order. Throughout Europe, in Italy, in France, and in the Low Countries, with the invention of printing, agricultural literature was accumulating on an unprecedented scale and a large number of writers were animated by the new opportunities which the changes of the time were revealing. Walter of Henley's treatise, pre-eminent in England for so long, was at last superseded, and the "good husbandries" of Fitzherbert (1523), Tusser (1557), and Googe (1577) prepared the way for later achievement. New crops, new methods, new fertilizers, new implements were discussed with energy, and the seventeenth century promised to begin a new era of agricultural prosperity.

It was a promise not to be fulfilled however until accumulated capital and a rising population had provided both the means and the incentive to improved technique. But the changes that accompanied the rise of individual ownership brought with them the need for a more accurate definition of land boundaries. The open-field system, it is true, had presented a perennial problem of surveying: its multitude of strips gave ample opportunity for dispute. But the enclosure movement brought the problem within manageable proportions and provided a demand which, especially in view of the improved husbandry, was becoming a paying proposition. And so, as a by-product of contemporary literary activity, there appeared in England a large number of treatises on the

"Art of Surveying of Land." Their popularity is shown by the fact that they were so frequently reprinted; their significance by the fact that surveyors like Fitzherbert and Norden were the great panegyrists of enclosing.

The Agrarian Extent

What we call surveying is only a fragment of what mediaeval men called surveying. To them it was much more than measurement, and it included many functions that have since passed to the estate agent and the farm manager. They knew the agrarian survey officially as the "Extent" whose form and substance was regulated by a statute of 1276 ("Extenta Manerii" [1]) containing "Directions for making Survey of a Manor," which really amounted to an inventory drawn up by "true and sworn men." Its instructions ran: "It is to be inquired . . . how many Fields are of the Demesnes, and how many Acres of Land are in every Field, and what every acre is worth by the year. . . ." Some of these instructions were included in the "Fleta" [2] which Seebohm [3] has described as the *vade mecum* of the landlords of the time of Edward I, and which, despite its many imperfections, at least advised landlords to have a survey made on taking over property so that they might know the extent of their rights and income. The method of the measurement however was dubious and remained so despite the frequent distinction that was made in inquisitions between land "quae continet per aestimationem . . ." and that "quae continet per mensurationem . . ." The "Statutum de Admensuratione Terre "[4] of 1306 did little beyond setting forth the dimensions of the land that could be enclosed by an acre. The confusion between customary and statute acres persisted. And apart from the general unreliability, estimates frequently included a large measure of chance; rights were sometimes marked by the cast of a hammer; the boundary between the shires of Cambridge and Huntingdon ran in some of the meres "as far as a man might reach with his barge-pole to the shore"; the day's journey and the morning's ploughing were other convenient units.

The sixteenth century however brought new necessities. The enclosures involved many changes in occupancy and the court rolls are full of the buying and selling of land by customary tenants. The surveys of the time also show manors in every stage of the transition from open field to enclosure, and not infrequently common meadows and pastures were divided among tenants so as to give each the exclusive occupation of a few acres.

Mr. Tawney [5] in an appendix prints an entry (dated 1608) relating to one of the estates of Merton College, Oxford.

> Good Sir lett me intreat you yf the colledge determyne to make survay this springe of the lands at Kibworth and Barkby to send Mr. Kay or me word a month or 3 weeks before your coming that we may have Beare and other necessaries. And I desire you to gather up all evidences that may be needful

[1] 'Statutes of the Realm,' vol. 1, p. 242.

[2] The best text is that edited by Thomas Clarke (London 1735).

[3] 'The English Village Community' (1926), p. 45.

[4] 'Statutes of the Realm,' vol. 1, p. 206. See F. W. Maitland's remarks on mediaeval measurement in 'The Domesday Book and Beyond' (1897), p. 370.

[5] 'The Agrarian Problem in the Sixteenth Century' (1912), App. I, from Merton MSS., No. 4381.

for ye Lordshipp, for all testimony will be little enough, the college land is soo mingled with Mr. Pochin's frehold and others in our towne.

But such surveys did not always result in maps. Frequently they were but "elaborate topographical descriptions, furlong by furlong, and strip by strip, of complete villages, extending sometimes in length to a hundred pages of manuscript," as those in the muniment room of King's College, Cambridge, which W. J. Corbett [1] has described.

This regrouping and reorganization provided every opportunity for disagreement. Complaints arose over rights; titles were called into question; quantities were disputed—all added fuel to the general agrarian discontent of the time. In the confusion there was much that is obscure, but one great fact stood out—the need for accurate measurement, and throughout the country repeated appeal was made to the surveyor, who frequently shared much of the odium attached to the more grasping encloser. An early seventeenth-century notice [2] in a complaint against the enclosing landlord declared that "the surveyor is his quartermaster which goes like a bear with a chain at his side, and his two or three parishioners who walk with him help him to undo themselves." The farmer on the first page of Norden's 'Dialogue' (1607) made a similar charge:

> I have heard much evill of the profession, and to tell you my conceit plainly I think the same both evill and unprofitable . . . and oftentime you are the cause that men lose their land and sometimes they are abridged of such liberties as they have long used in mannors.

But tenants themselves frequently called in the surveyor, and the 'Surveyor's Dialogue' set forth among other things the functions of the surveyor: "how to enter and inroll Copies, Leases, and Deeds, and how to take the plot of a mannor," and later is shown "the manner of the casting up of the quantities of Acres of all sorts of grounde by the scale and compasse, with Tables of computation, for ease in accompting."

Contemporary with John Norden was Ralph Agas, who was responsible for topographical maps of Oxford, London, and Cambridge [3] and whose opinion was sought in connection with various commissions dealing with concealed lands belonging to the Crown. He issued a printed statement [4] (undated) apparently in the nature of advertisement. It now lies among the Lansdowne Manuscripts and provides an instructive comment on the difficulties of the time.

> *To all Persons whom these presents may concerne, of what estate and degree soever,*
>
> No Man may arrogate to himselfe the name and title of a perfect and absolute Surveior of Castles, Manners, Lands and Tenements unlesse he be able in true forme, measure, quantitie, and proportion; to plat the same in their particulars *ad infinitum* and thereupon to retrieve, and beat out all

[1] "Elizabethan Village Surveys," *Trans. Roy. Hist. Soc.*, 1897, p. 67.

[2] Harleian Misc., vol. 9.

[3] Hurst, 'Oxford Topography . . . Forming a companion volume to the portfolio containing Agas's maps 1578–88, etc.' (1899); and W. H. Overall ('Some particulars as to the early maps of London and more especially to the map attributed to R. Agas') (1874). No copy of the Cambridge map is now known to exist.

[4] Lansdowne MS. 165, fol. 95.

decaied, concealed, and hidden parcels thereof, fitting the same to their evidence, how ancient soever; although blemished, obliterate, and very much worne; besides the qickening and reviving of Rents, Customes, Liberties, Priveleges, Etc. thereunto belonging; with perfect knowledge of customarie Tenures and Titles of all sortes: framing entries accordingly: together with good and commendable penmanship as well for the Plat, as Booke, from the same. And for that more abuse in concealments, incroachments etc. hath beene offered in these last 100 years than in the 500 before and that many do now refuse (as more will heerafter) to pay their rents and duties, otherwise than on the meeres head, (their lands and Tenements first singled out, and set forth unto them, *metis and bundis*). I may not terme him so much as a Surveyor that performeth not these difficulties, and such like incident to Survey.

By *Radulphus Agas* of *Stoke* next *Nayland* in *Suffolck*,
Practised in Survey more than 40 *yeeres*.

The hostility towards the surveyor may or may not have had a legal justification, but it certainly had a real excuse on technical grounds. The hint about inefficiency in Agas's statement explains much discontent, for the efforts of the surveyors to meet the new necessities were at first very experimental. It was the geometrical revolution that turned the science of measurement into something more than an incidental branch of husbandry.

The Geometrical Revolution

John Dee in his introduction to the first English translation of Euclid in 1570 echoed a change that was already making itself felt. How many were the errors and difficulties, how great the injustices and losses, he says, "Till by God's mercy and man's Industrie, The perfect Science of Lines, Plaines and Solides (like a divine Iusticier) gave unto every man his owne. . . . Geometria, that is (according to the very etimologie of the word) Land measuring." Conditions in England during the sixteenth and early seventeenth centuries bred a large number of treatises dealing with new science. They can be considered from the point of view of (1) their aim, (2) their contents, (3) their difficulties.

(1) The treatises laid great stress, some by implication, others by direct statement, on the fact that they revealed something. The book of measurement that appeared in 1537 was prefaced by one Thomas Paynell who wrote: "Considering then this liberal science called geometrye to be in everything much convenient for the use and common profit of all men, a friend and lover of mine, Syr Richarde Benese, not willing to hide the treasure . . . hath compiled this ingenious and profitable book for the common profit and use of every man." Leonard Digges in 1556 was likewise anxious "not to hide but to open." For although many excellent rules in geometry had been set forth, he declares them to be "hyd, and as it were locked up in strange tongues"; so now he revealed to all "the exacte measurynge and speedy reckenings all manner lande." But apparently there were difficulties, and Edward Worsop in 1582, believing that earlier works could not "be understood of the common sorte . . . thought good by a plaine and popular discourse, to laie open unto the understanding of every reasonable man, the necessities and commodities of those singular workes and knowledges." And as late as 1662 George

Atwell was claiming "I write to be understood of all, and so bent my Countrey-stile to the capacities of those I supposed would chiefly put the contents of it in practise." This plea for the practical side is all the more intelligible from his remarks on those who "have good skill in the theorie, but as little in the Practick" . . . especially that London mathematician who was "a perfect Surveyor, but never saw an acre of land measured." And the constant emphasis on being clearly understood was but natural, for enclosures affected almost every one. They were the burning question of the hour, in Parliament, in the pulpit, and among the greater part of the peasantry.

(2) What they revealed was very practical. The instructions of Benese were: "When ye shall measure a pece of any maner of lande, ye shall go aboute the boundes of it once or twyse and consydre well by vewynge of it, whether ye may measure it i one parcell hole togyther or els in two, or many parcelles. For some maner lande lyeth in suche dyvers fasshions that it muste nedes be measured in dyuerse parcells, eche one by them selfe." This was followed by a consideration of the properties of triangles, and nearly all subsequent treatises came to be copiously illustrated with diagrams showing the application of triangulation to varying topographical features.

In the seventeenth century the response to the demands of the time was making itself felt and treatises were increasingly devoted to instrumental improvement. Professor E. G. R. Taylor[1] has described the appearance of the plane table in the sixteenth century; and the "Pantometria" (1571) of Digges describing an early form of theodolite, depicted under the title "Topographical Instrument,"[2] was but a prelude to many experiments. New instruments followed one another in rapid succession. Aaron Rathborne, with his Peractor and with a chain called "the Decimall Chayne, . . . which rightly understood and practised . . . is far more usefull and absolute for speed and exactnesse, then any yet ever used," was eclipsed in activity by William Leybourn with an instrument "which will perform all the uses of the Theodolite, Semicircle, Circumferentor, and Peractor, and for Portability exceeds any of them"; then he produced a "newe kinde of Protractor which is far more convenient for use than that which is usually made"; and followed that by a new device by which a man "may be satisfied whether his Plot will close before he begin to protract the same; to say nothing of another instrument called the Panorganon," "for the solution of such problems" (declared the preface) "as are of frequent use in the practice of Geometry, Geography, Astronomy, Trigonometry, Dialling, Projection, etc." This great activity of one man is symbolical of the new epoch and even the orthodox husbandries like Walter Blith's "English Improver Improved" digressed to consider "certain Tools or Instruments, which shall much facilitate the Work."

(3) There were difficulties in the way of this progress. For many ill-equipped people called themselves surveyors and, says Worsop, did not hesitate to "intrude themselves into that weighty function as sufficient." Rathborne too complains of "the multitude of simple and ignorant persons"

[1] *Scot. Geogr. Mag.*, vol. xlv, p. 205 (1909). See also 'Tudor Geography,' London, 1931.

[2] See R. T. Gunther, "The Theodelitus of Digges," in the Old Ashmolean Reprints (Oxford, 1927).

who provided themselves with that "good plaine Instrument called the Plaine Table" and proceeded to misuse it. As the sixteenth passed into the seventeenth century, complaints grew more and more frequent. Some of the correspondence between Agas and Lord Burleigh, the Lord Treasurer, is extant, and it is full of dissatisfaction with contemporary methods. In 1592 he was complaining that "the greate number of lande meaters at this presente, with the diversitie of device for measure are soe differinge among themselves, ... as infinite errours are therein dailie committed, and the rare and excellente skill in measure almost utterlie condempned."[1] Four years later he wrote from the Fens that "almoste as manie errours are comitted as there are operacions undertaken."[2] It was this state of affairs that prompted him to bring out his text-book in 1596, in the preface of which he confessed:

> Why I had determined before, and doe now set downe as followeth, groweth upon the infinite and extreme imperfections, that I finde in most places where I become to be daily committed, as well in measure, as platting of lande to any use or purpose whatsoever; which are such and so manie, as the people generally beginne to doubt, whether there be any certainety, and perfection, in the perfection of such instruments as are applied thereunto, yea, or not. The practise hereof for serveigh of lands and tenements, is but new and scarce established; notwithstanding I doe affirme and undertake, that it is certaine, perfect and true, without any want or defect.

It really amounted to the caution given by Edward Worsop in 1582 that any one who measures land is not to be accounted a surveyor "except he can also prove his instruments and measurements, by true Geometricall Demonstrations." And this is a long way from the statute of Edward I.

"Without good and exacte Surveighes," wrote Agas,[3] "manie slippes, escapes, and evations wilbe committed of great momente and weight." And Rathborne prefaced his book with the address:

> Both simple, gentle; Barons, Lords, and Knights,
> Will take thee for their chiefest of delights.
> Thou teachest them to measure all ther grounde;
> Which, certainly,, will save them many a pound.

For, amid the many changes of the sixteenth and seventeenth century, accurate measurement certainly helped[2] to preserve "eatch man's Interest, inviolable and sounde."

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[1] Lansdowne MS. 73, Art. 29.
[2] *Ibid.* 84, Art. 32.
[3] Additional MS. 12497, folio 342.

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WOUTNEEL'S MAP OF THE BRITISH ISLES, 1603

EDWARD LYNAM

IN the Geographisches Seminar of the University of Göttingen there is a copy of a map of the British Isles which I believe is at present the only copy known. It was briefly described by W. Reinhard on pp. 128–129 of his 'Zur Entwickelung des Kartenbildes der Britischen Inseln bis auf . . . 1564,' and is evidently the map by "Wortnel," referred to in John Gregorie's 'Description and Use of the Terrestrial Globe,' 1649. I have found no other reference to it. Through the kindness of Bibliotheksrat Dr. W. Vogt and Dr. Hans Dörries, of Göttingen University, a photostat of the map has been supplied to the Map Room of the British Museum. Dr. Dörries, to whom I am much indebted for information on various points, writes that the map came to the Library of Göttingen University about 1735, from the collection of a certain Herr Franzius, of whom nothing is known. It was a large sheet, 81 cm. broad by 103 cm. high, attached to rollers and kept in a special box. The rollers have since been removed and the sheet cut, backed, and folded into four. I shall call the map Woutneel's, though Kip, the engraver, was probably equally responsible.

Across the top of the map a large rectangular cartouche contains the inscription: *A Descripsion of the Kingdoms of England, Scotland & Ireland With al the Ilands adiacent vnto them, also the Battails that haue bin fought . . . expressed by the figures of Tents, in their proper places . . . Where unto is added the Genealogie & Pourtraitures of ye kings of England. Frome William the Conqueror To our Soverain Lord King James now Raigning Anno Domini* 1603. Left of this, below the royal arms, there is a small oval cartouche containing the words: *To the Most Highe . . . Prince Iames . . . His Maiesties most Loyal Subject John Woutneel . . . Presenteth this Description.* Beneath this is a *Catalogue of al the Cities, Busheprickes, Markete townes,* etc., in each county of England and Wales. The right side of the map is occupied by a tree, with portraits of the monarchs of England, headed *The Royall Progenei . . . unto his . . . sacred Maiesty ano* 1603. This is separated from the map by a broad ornamental border, and below it appears *Grauen by William Kip. At the charge of John Wintēell.* The scale is "60 English Myles" [=96 mm.] "answerable to a degree of Latitude," and was probably copied from Saxton's map of 1583. The co-ordinates are shown in the margins.

Hans, or John, Woutneel is known as a Flemish bookseller in a small way, who lived in London *c.* 1585–1607, and was a correspondent of Ortelius's. In 1592 he was associated with Crispin van de Passe I in the production of a portrait of Queen Elizabeth, and published two later portraits of her, in 1596 and in 1603, by the same engraver; his name appears, substituted for that of Saxton, as publisher of a map of Essex dated 1602; and in 1603 he also published, in honour of King James, a *Roiail Progenei* or tree of the Scottish kings, with fourteen portraits, which was engraved by Benjamin Wright. From the dedication of the present map he seems to have become a naturalized Englishman. Kip was a Dutch engraver, generally resident in London, who engraved Norden's map of Hertfordshire (1598) and thirty-four of the maps in Camden's 'Britannia' (1607).

England and Wales on this map, with the *Catalogue of Cities,* are closely copied from the second, anonymous, edition (1594) of a map published by Jodocus

Hondius in 1592, of which second edition a copy is owned by the Royal Geographical Society, and was reproduced in 'English County Maps in the Collection of the Royal Geographical Society' (1932). Woutneel's map however is larger, is without most of the Latin names given on the 1594 map, shows more place-names, and has several names differently spelled. Many of the new names have been taken from Saxton's general map in his atlas (which was itself the source of the 1594 map), yet more from his map of 1583, while one (Woodcote in Surrey) I can only trace to an anonymous map of Surrey of 1602, one of a group of anonymous county maps to which Mr. Heawood has drawn attention (*Geogr. J.*, October 1926; 'English County Maps in R.G.S.,' 1932). Some of the names are spelled in a way which suggest that they were copied by a Fleming or Dutchman. *E.g.* Aldburg, Apledowre, Falmouth, Sheppey, and Waymouth on the 1594 map have become *Aldburgl*, *Apledoweer*, *Falemout*, *Schepp*, and *Waymoutl*, forms for which I think no English sources exist. It is noteworthy, too, that the water-mark (which is that listed as no. 80 by Mr. Heawood in his valuable paper in *Geogr. J.*, May 1924) has been found on a number of maps of 1596–1613, all of them, except this and those in Speed's 'Theatre' (1611), Dutch maps. As Speed's maps were engraved by Jodocus Hondius, it may be that both they and this map were printed at Amsterdam, though against this should be set the fact that this watermark does not appear on the "proof-sheets" of 1605–10 of Speed's maps in the British Museum. There is therefore some ground for believing that the 1594 map may have been copied, altered, and enlarged for Woutneel in the Netherlands (where it was well known and was re-engraved in 1606) and the drawing sent to London for Kip to engrave, together with a supply of paper for printing. It seems almost equally likely however that these errors in spelling were Woutneel's, which Kip the engraver had neither the knowledge nor the authority to correct.

Since Scotland was not included in the map of 1594, it is here copied from Ortelius's version first published in 1573, with all its faults. Ireland is very interesting, for though mainly based on the 1594 map, which in turn was based on Boazio's map, it diverges in details both from that and from all the copies, or rather versions, of Boazio's map that I have seen. North-western Ireland is yet more interesting, for it appears to be copied, not from an engraved map, but from Boazio's MS. map of Ulster of *c.* 1602 (B.M.), a map which Speed seems also to have used. The Ireland of the 1594 map does not seem to have been entirely copied from any known map by Boazio, and a thorough examination of all Boazio's maps of Ireland or of parts of it is needed.

The indication of "Battails by the figures of Tents" was a novel feature for its time. Some of the anonymous county maps of 1602–3 mark the sites of battles by artistic engravings of soldiers fighting, and Speed employs both tents and massed ranks of infantry. Woutneel could have made lists of the battles from Holinshed's or other chronicles, but his location of battlefields often shows great ignorance; Solway Moss, for instance, is placed near Dunbar, close to the east coast. Yet, though one generally suspects Woutneel of copying, this may well be the first engraved map of the British Isles which shows the sites of battles. Though Kip was presumably in touch with Norden, the errors of placing show that he could hardly have utilized the manuscript "Map or Draught of all Battles fought in England" which Norden is supposed

to have drawn. Most of the "Pourtraitures of ye kings of England"—a poor lot, on the whole—are copied from 'A Booke containing the True Portraiture of . . . the Kings of England,' by "T. T." [Thomas Twyne or Timm], 1597. A series of good engravings of the engagements between the English fleet and the Spanish Armada appears in the English Channel and the North Sea. They are obviously based upon Ryther's famous engravings (1590), but inferior to them. These engravings were copied on Speed's 'Map of the Invasions of England and Ireland' (1627), the engraver of which was Cornelis Danckertsz. This seems to be the only later map which was influenced by Woutneel's map.

Mr. Heawood has put forward the attractive suggestion that the anonymous county maps of 1602–3 were possibly part of a projected new atlas of England, sponsored perhaps by Ortelius or Camden. I had hoped that the present map would prove to be the general map of that atlas, but unfortunately can find little evidence for that. Even allowing for the necessary differences in a general map, none of the features common to the county maps appear here, and there are no real resemblances in the lettering, engravings of ships and monsters, or other details. The watermark is also different. The style of Kip's work in this and his other maps makes it unlikely that he engraved any of the anonymous maps. Essex, the only one of them (and it is rather different from them in some respects) which bears Woutneel's name, cannot have been the basis of the Essex in this general map. The map was printed on four sheets, as is shown by the lines quartering it and the occurrence of the watermark in each quarter. Although each sheet measures roughly 40 by 50 cm., which is about the size of the county maps, this does not prove that the map was meant to be published in four "atlas" sheets, but merely that it was too large for one plate. The quarters bear no distinguishing number or label, as do the sheets of Saxton's map of 1583 and of the "Quartermaster's Map," which were probably intended to be bound in volumes. A patient study of Woutneel's map may reveal other connections with the county maps besides the borrowing of "Woodcote," mentioned above. The decorative border round the *Royall Progenei* is very like that on the anonymous map of Northamptonshire.

For some reason, Woutneel forsook the latitudes and longitudes of his original, though the latitudes, being Saxton's, were there remarkably good. Woutneel stretched the mainland of England and Wales some 15′ northwards. He did the same for Ireland, but with better results, for the 1594 map placed northern Ireland too far south. Boazio, by the way, though his Irish longitudes were very much better than those of the 1594 map, placed the north coast of Ireland more than a degree too high.

It cannot be claimed that this map is of great importance as a cartographical work. Except in Ireland and in the marking of battlefields, it reveals no original research. It is full of mistakes, showing hasty and unintelligent copying (Tintagel Castle and Ashburton are each shown in two places). Neither Kip nor Woutneel was skilled in geography, and Woutneel probably published this map, as he published portraits of Queen Elizabeth and of the Scottish kings, to win favour at court and earn a more or less honest penny. The map is interesting on account of the sources utilized, on account of Kip's fine engraving, and on account of its size and its rarity. Possibly these notes, though put together rather hastily, may serve to bring other copies to light.

WATKINS' KAYAK

J. R. RYMILL

THE kayak which we found adrift on 20 August 1932 has been hung among the relics in the Museum of the Society with all its hunting gear in place; and the following brief account is designed to explain its construction and use.

The East Greenland kayak consists of a wooden frame covered with seal-skin, usually of the crested or bearded seal. It requires great skill and long experience to make a kayak frame. The young men seldom build their own, usually getting help or leaving it entirely in the hands of an old and experienced hunter. If the curves are not just right the skins will be cut by young ice, or if the proportions are slightly wrong it will be a bad boat in a rough sea. Each kayak must be made to fit its owner, for when one is in a kayak it must be part of one, neither moving independently of the other. If this were not so it would be quite impossible to right the kayak again after it had been capsized, which is actually quite an easy thing to do either with the paddle, harpoon thrower, or hand alone. When the kayak frame is finished the women cover it with seal-skin, sewing it with sinew thread and using a waterproof stitch. This is done by passing the needle through only half the thickness of the skin at each stitch, therefore when the thread is pulled tight there will be no stitching visible on the outside of the skin. When the women have finished the covering, the whole kayak is given several coats of blubber to preserve the skins and also to fill up any small holes left in the seams.

We will describe the kayak gear, beginning from the bows. First comes the framework for the screen. This screen is made of white material and may be seen rolled up and lying under the tray holding the harpoon line. When the screen is rigged on the frame for hunting it looks remarkably like a small piece of drifting ice when seen from some distance in front of the kayak and is used to hide behind when stalking a seal.

Behind the screen frame comes the tray for holding the harpoon line. Under the tray will be seen a seal-skin rifle bag. Between the tray and the cockpit is a collection of small wooden objects which are used for plugging holes in dead seals to prevent the blood escaping. One of these is longer than the rest. This is forced between the skin and blubber of the seal and the hole thus formed is filled with air and when plugged causes the seal to float while being towed behind the kayak. Near these pegs is a piece of wood pushed under the seal-skin bands which go over the kayak deck. When fishing and shooting or getting in and out of the kayak one end of the paddle is placed under this piece of wood in such a manner that it will hold the paddle at right angles to the kayak, thus giving the effect of an out-rigger. Lying along the right side of the kayak is the harpoon, in such a position that it can be quickly picked up in the right hand. The end of the harpoon consists of a narwhal-ivory shaft about 18 inches long attached to the main wooden shaft by short seal-skin thongs. Behind the cockpit is a bladder float made from the skin of a young fjord seal. This bladder is attached to the harpoon line, which is coiled up in the tray. On the other end of the line is the harpoon head, which lies in the

centre of the tray. When the kayak is rigged for hunting the harpoon line lies along the harpoon shaft, and the head, which has a small hole between the barbs, is placed on the ivory end of the harpoon. The line is then pulled tight and attached to a bone peg about halfway down the shaft by means of a toggle, any slack line is then taken up and coiled in the tray. When the end is given a strong pull sideways it becomes detached from the wooden shaft, thereby slackening the harpoon line and freeing the head. When the harpoon is thrown the hunter immediately throws the bladder overboard. After the line has run out of the tray, which is a matter of a few seconds, the harpooned seal has no connection with the kayak. One of the dangers of this method of hunting is the possibility of the line being badly coiled and catching as it runs out of the tray, or else getting caught on part of the deck cargo, in which case the hunted seal would overturn the kayak as it pulled on the line. The hunter usually carries a knife on the deck pushed under the two thongs which hold down the back support of the tray. If he is overturned he can cut the line while upside down in the water and then right himself in the usual way. Behind the cockpit and to the right of the bladder is the paddle. This is made as short and as narrow as possible with a protective covering of whalebone or narwhal ivory along both edges and at the end of the blades, which are very thick. This construction is necessary as the paddle is often used as a pole when pushing about among ice floes. The bone edges are necessary when breaking through young ice, for without their protection the paddle would be cut and splintered in a few days.

To the left of the bladder is the lance. This is used for killing wounded seals and is thrown with the same throwing stick as the harpoon. Unlike the harpoon however it has no barb on the end. When the lance strikes a wounded seal the end becomes detached, and as the thongs holding the end are fastened in the centre of the shaft, it will float at right angles to the head, and thus the drag on the shaft will pull out the head of the lance as the seal swims through the water. The lance can then be picked up and used again. This should be unnecessary with a fjord seal, but when hunting larger seals or narwhal it is sometimes necessary to throw the lance several times before hitting a vital spot.

Seals must be the staple food for anybody proposing to live off the country in South-East Greenland. To procure seals in these waters it is essential to become an efficient kayak hunter. During the summer months if seals are killed while in the water they will sink at once. To prevent their sinking and so being lost, the Eskimo has evolved a method of harpooning them with the harpoon head attached to the bladder float. This cannot be done from a boat as the seals are too shy to come within harpoon range; so the kayak must be used with its protecting screen. When hiding behind this screen it is possible for a good hunter to approach within a few yards of a seal. The seal can then be shot and harpooned while it is sinking, or if the hunter is expert enough it may be only harpooned.

In Greenland on H. G. Watkins' last expedition we had a small supply of provisions, but we relied on the country to furnish us with the greater part of our food. We had no difficulty in providing for ourselves, but it occupied about half our time.

There is a certain amount of risk attached to kayak hunting which was made

very apparent by the tragic death of Watkins when his expedition had only been in Greenland for a few weeks. According to evidence which we found I do not think there is very much doubt concerning the cause of his death. I will not give a detailed account of the evidence here as it could only be appreciated by an experienced kayaker; it is sufficient to say that we found his trousers and kayak apron on a very small ice floe close to an active glacier. His trousers were wet and must have been in the sea. We also found his kayak floating full of water and with the hunting gear not seriously out of place.

If while out hunting the kayak screen is knocked by a piece of ice it is likely to get disarranged, and if this happens it is necessary to get out of the kayak for a few minutes to right the screen, as it cannot be reached from the cockpit. We think this happened to Watkins' screen, and he, thinking he would only be a minute, landed on a small floe in a dangerous locality. While on the floe a large piece of ice broke off the glacier, starting a wave big enough to upset the floe on which he had landed. There was a strong wind blowing off the glacier at the time, which would carry his kayak away while he was climbing back on to the floe. He then took off his trousers and kayak apron and tried to swim after his kayak. It would be impossible for him to get into his kayak in the water and he must have been overcome by the cold before he could get it to an ice floe. This of course is only a theory, but from the evidence we found and from personal experience it seems the only possible solution to a great Polar tragedy.

REVIEWS

EUROPE

THIS LAND OF OURS: a simple explanation of the basis of scenery. By WILLIAM PLATT. *London: George Allen and Unwin* 1933. $7\frac{1}{2} \times 5$ *inches;* 104 *pages; illustrations.* 2*s*

This little book should be useful in introducing young readers to the elementary facts of geology. It is not a complete explanation of scenery, as the emphasis is mainly upon the formation and characteristics of rocks, and the nature of fossils. It also suggests forcibly the scale upon which the weathering of rocks is taking place. There is obviously much more to be considered before the evolution of types of scenery can be understood—as is hinted at in a brief chapter. The style is simple, but not without suggestions of "writing down" to the level of young readers. G. R. C.

THE HANDBOOK TO THE ROMAN WALL. By J. COLLINGWOOD BRUCE. Ninth Edition. Edited by R. G. COLLINGWOOD. *Newcastle-upon-Tyne: Andrew Reid & Co.; London: Longmans, Green & Co.* 1933. $7\frac{1}{2} \times 5$ *inches;* x+222 *pages; illustrations and map.* 3*s* 6*d*

Just seventy years ago first appeared what became a trusty old friend, Bruce's book on the Roman Wall. It is now issued in its ninth edition, edited by Mr. R. G. Collingwood. The reviewer's much-handled copy is of the seventh edition, 1914, which had 284 pages and cost 2*s*. 6*d*. quarter bound. The present edition has 221 pages and costs 3*s*. 6*d*. whole bound. In recent years knowledge of the Wall has grown vastly, but happily it has been found possible to insert the chief results in Bruce's framework. The shortening is due to the omission of three very brief chapters, now unessential, and an appendix on excursions. Chapter III, Local Description, has been expanded in some respects, but lightened in others. The very useful appendix containing a select bibliography will appeal to archaeologists and historians, and there are also some new illustrations. The Book of the Pilgrimage of 1930 strongly suggested that a new edition of Bruce was desirable, and its appearance is matter for congratulation. The multifold map of the course of the Wall, with corrections to date, is much the same as before. Bruce remains the friendly, eloquent, and philosophical guide. S. E. W.

THE INDUSTRIAL REVOLUTION IN NORTH WALES. By A. H. DODD. *Cardiff: University of Wales Press Board* 1933. $9 \times 5\frac{1}{2}$ *inches;* xxxii +440 *pages; maps.* 12*s* 6*d*

Professor Dodd has written an interesting and informative work, which covers more ground than is promised by the title. He interprets the term "industrial revolution" sufficiently widely to include detailed studies of the agricultural and social life of the North Wales countryside. It is difficult in English economic history to determine an exact date for the beginnings of the revolution, which in some aspects may be traced back to the sixteenth century. In the middle of the eighteenth century however North Wales had advanced little beyond its condition in Tudor times: the development of the economic departure is therefore more easily traced, and its results more clearly recognizable.

Before the period opens, the region was practically an isolated agricultural community, untouched by advances in farming practice, with a number of small domestic industries. Its relations with England were important as offering a market for the chief export, cattle—and a source of grain supplies. It is surprising to learn that by this date even Anglesey and Carnarvon had come to depend upon

English grain. Professor Dodd's theme is the changes wrought, first by "spirited proprietors," later by capitalists, many of them English, stimulated by European war. Mining, quarrying, woollen, and other textile industries flourished for a time in varying degree, only to be beaten in the end by their English competitors, for North Wales was badly situated and insufficiently endowed by nature. The author shows how the development of trunk roads, and later of railways, which was concentrated on the northern coastal strip to Holyhead, increased the handicap, and he attributes the failure of the flannel industry largely to this neglect to open up Central Wales.

The author preserves a non-committal attitude throughout, but the reader will draw the conclusion that the region had little reason to bless the revolution, for the era comes to an "untimely close" with tales of collapse and destitution. The book is written in a vigorous style, enlivened with quotations from contemporary writers, and has a map above the usual standard. G. R. C.

ASIA

SPORT AND EXPLORATION IN THE FAR EAST: a naturalist's experiences in and around the Kurile Islands. By STEN BERGMAN. Translated (from the Swedish) by FREDERIC WHYTE. *London: Methuen & Co.* 1933. 8×5 *inches;* x+246 *pages; illustrations and sketch-maps.* 10s 6d

The title of this book is, in a way, misleading. True, there is plenty of sport of a kind in it and also of exploration in a manner of speaking, but the author is neither the conventional Nimrod with tales of prowess in the presence of ferocious wild beasts nor a discoverer of lands hitherto unknown to man. He is, in fact, a naturalist with a soft heart and a sense of humour, whose shooting is done mostly with a camera and whose exploration work is restricted to a close and sympathetic study of nature, including man, in a region of the Japanese Empire long ago explored, surveyed, and mapped, and now efficiently administered.

The book is concerned with an expedition, in 1929–30, by the author and one European companion to the Kuriles, the 800-mile-long chain of volcanic islands that link Kamchatka with Japan and enclose the Sea of Okhotsk. Though the winters are cold and stormy and many of the islands bare and treeless, the fauna is extensive, while the flora presents many peculiar features. The author passed eighteen months on the islands and the waters around them. His collections of plants and animals, including six thousand insects, now enrich the Stockholm National Museum, and the complete record of his work will shortly be available to the world of science. This book is an account of his experiences written for the delectation of the general reader, an object it is more than likely to achieve, for the author describes his life in the islands with a captivating enthusiasm and the judgment of a practised raconteur. He learns the art of harpooning whales, walks the sea-floor in a mussel-diver's outfit, suffers shipwreck, is lost in a snowstorm, and thrives on the local diet of rice eked out with crabs, cuttlefish, whaleskin, and seaweed. He testifies to the kindness of the poor but hospitable people with whom he is thrown, and devotes a chapter to the proclivities of his Japanese friend and servant. Incidentally Dr. Bergman reveals much that is interesting concerning the local administration, more especially the activities of the Ministry of Agriculture in restocking the islands with the valuable fur-bearing and other animals that were almost exterminated under the Russian régime before 1875.

The translation of the book from Swedish into English has been well done; the illustrations from photographs by the author are good; there is an index, and, on the end papers, a map of a sort. W. A. G.

INDIA HOUSE LIBRARY: a short catalogue. *London: Office of the High Commissioner for India* 1933. 10×7½ *inches;* x+534 *pages.* 5*s* [*limited edition*]

The High Commissioner for India has presented to our Library a copy of this catalogue of the Library of India House. It is emphasized in the introduction that the Library is organized for information rather than for research. Its main contents therefore are publications of the Government of India, central and provincial, and of the Stationery Office. The catalogue is arranged on the Dewey system of classification, which tends to group the titles by subjects rather than topographically, but the subject- and author-index provided makes it simple to trace any book. The geographical section is at present small, but this is due no doubt to concentration upon economic and commercial problems.

G. R. C.

AFRICA

EGYPT SINCE CROMER. By Lord Lloyd. Volume I. *London: Macmillan & Co.* 1933. 9×6 *inches;* xii+390 *pages; maps.* 21*s*

This is the most important book published since 1908, when Cromer's great work appeared, on the subject of Egypt, which Napoleon when at St. Helena considered "the most important country in the world." The book, like its predecessor, has no official character, and inevitably reveals to us something of the character of the author as well as of the nature of the events with which it deals. Lord Lloyd's style, like Cromer's, is a fitting framework to his thoughts: it is solid, but it does not obscure the light, and we are never in doubt as to his meaning. This volume opens with the year 1904, and the signature of the Anglo-French agreement, and ends in April 1919. It deals comprehensively with the question of Capitulations, and the emergence of Egyptian Nationalism, and includes a very careful and balanced account of the aims and achievements in Egypt of Sir Eldon Gorst and Lord Kitchener. It does the fullest justice to both. Of criticism there is no lack, but it is primarily directed towards the policy, or lack of policy, in Egyptian affairs maintained by the Foreign Office. This administrative maladjustment is of old standing and is not confined to Egypt. It is the ineluctable accompaniment of a discussion of almost every large issue of foreign and colonial policy in the last hundred years. The French nation seems, of recent years, to have come nearer than we have to achieving a just balance between the views of men at the centre and the recommendations of those at the periphery. The electric telegraph has made things more rather than less difficult, but the problem is much older than the telegraph. The present volume will help us to understand some at least of the causes underlying the steady divergence of view over a period of nearly twenty years between His Majesty's Government and its successive Representatives in Egypt.

Of the war period Lord Lloyd writes in terms which reveal great sympathy with and insight into the Egyptian point of view, an aspect which, notwithstanding Lieut.-Col. P. G. Elgood's 'Egypt and the Army,' has not received adequate attention. Lord Lloyd explains very clearly how we contrived to antagonize all classes, from the most influential politicians to the peasant—the former by our attitude, the latter by our actions. The chapters on the Sudan—a region which awaits its political historian—are of special interest. He distributes praise with discretion, but liberally.

The book is more than a history: it is a confession of faith, and is therefore not without bias. Yet just as fiction is sometimes insight into fact, so is historical bias, if overt and intentional, as in the present case, less likely to be misleading than the uninspired periods of the impartial arbiter. To those who profess to

expound, with equal "impartiality," the views of the most clamorous exponents upon current history, on the basis not of life but of the printed word, this book will not be wholly acceptable, but the life of Governments and of nations is not in logic but in experience. Lord Lloyd's narrative is informed by personal experience. We look forward eagerly to the second volume. A. T. W.

THE GEOLOGY OF BRITISH SOMALILAND. By W. A. MACFADYEN. Part I of the Geology and Palaeontology of British Somaliland. Published by the Government of the Somaliland Protectorate. *London: Crown Agents for the Colonies* 1933. $9^1/_2 \times 7$ *inches;* 88+iv *pages; illustrations.* 12*s* 6*d*

Although this is a Government publication it is based largely on the results obtained by the Somaliland Petroleum Co. during the years 1928 to 1930. The data obtained on this and previous expeditions are presented in the short space of sixty pages. Part I however is restricted to general geology, and palaeontology will be dealt with in Part II.

In consequence of the principal work having been carried out by oil companies, attention is focussed on the sedimentary strata and tectonics, of which a comprehensive, though concise, account is given. The ancient basement rocks of the country have, unfortunately, remained comparatively unstudied though they have been recorded since the time of Burton. The Inda Ad Series of the basement rocks is tentatively referred to the Karagwe Series (known since 1926 as the Karagwe-Ankolean System) of Uganda and neighbouring territories, yet it is surprising to find no reference to the detailed work of the Geological Surveys of Uganda and Tanganyika Territory or to the official reports on Kenya Colony.

A short appendix on the petrography of the igneous and metamorphic rocks is contributed by Dr. Harker. Two other appendices, by Dr. Macfadyen, deal with the surface waters, wells, and springs, and a list of fossil localities. A feature of considerable importance is the inclusion of thirty scale drawings of strata sections together with palaeontological and lithological notes. These are the work of Dr. Macfadyen and Mr. J. A. Hunt. A pocket at the end of the volume contains a coloured geological map on a scale of 1 : 1,000,000 compiled from the maps of (1) the Anglo-Persian Oil Co. Expedition 1920–21, by B. K. N. Wyllie and W. R. Smellie ; (2) C. Barrington Brown, 1931 ; and (3) the Somaliland Petroleum Co. Expedition, 1928–30, by W. A. Macfadyen and J. A. Hunt. A. W. G.

NORTH AMERICA

THE LAND THAT GOD GAVE CAIN. An account of H. G. Watkins' Expedition to Labrador, 1928–1929. By J. M. SCOTT. *London: Chatto and Windus* 1933. 9×6 *inches;* viii+282 *pages; illustrations and maps.* 12*s* 6*d*

Watkins had his first experience of the Arctic when he visited Spitsbergen in 1927 and led a small party into the interior of Edge Island. More sledging experience was however necessary before he could launch out on the big expedition to Greenland which he was already contemplating. The Labrador venture was chosen to give him what he wanted, and so it came about that these two, Scott and Watkins, both at Cambridge but up till then strangers, joined hands for the first time and began the series of tough journeys which they were to make together during the next three years.

Scott has written the best book on Labrador that I know. No attempt is made either to crack up the country or to run it down. Between the lines one can see how great a future there may be. Scott however is content to set down very simply, and yet very vividly, the travel conditions as he and Watkins found them

in summer and in winter. Apart from minor trips there were three main efforts. The first was a late summer journey by canoe up the Kenamu River and back down the Traverspine. Both men were strangers to this kind of work, and they were piloted by two trappers, with L. A. D. Leslie as a third tenderfoot. One of the local men, Robert Michelin, was to be their companion on all their journeys, a typical Labrador trapper, hardy and simple, who would scarcely have bothered much about these beginners had they not been quick to prove themselves worthy to live and travel among his own hard race.

The next journey was made in mid-winter northwards from the base at North-West River by Lake Nipishish and Lake Snegamook (hitherto unvisited by white men) to Hopedale and back. It was a much harder journey than the first; they were new to sledging, and Scott sums it up when he says that they were never so tired as on those endless days of tug-of-war, when they would rarely get through supper without falling asleep, and sometimes even dozed in the middle of a mouthful. Robert was again their teacher, showing them how to hunt and how to cook, how to mend snowshoes and moccasins, to light a stove and make a brushwood bed, and how to keep an axe sharp and use it rightly; in fact, how to be comfortable on the trail. At the end both were played out and only too glad of some rest; but in little more than a week they were ready for more.

The third journey was the main event in the expedition—the others were merely preparatory—and was to take them westwards past Grand Falls to find out the real lie of the waters and the location of other falls, reported and rumoured, whose importance in regard to Grand Falls had yet to be assessed. The journey was a long one; food ran short and many of the dogs died. Scott and Watkins had the will to push on; they were doing what they wanted to do; it was their purpose in coming from England; but Robert had no such urge, only duty to his masters. Watkins stuck to it and carried out his intention, found two new waterfalls, and made a first map showing their relation to Grand Falls and to other points on Unknown River.

Scott writes about his friend, and his work is a worthy tribute. It is lively writing, and he has the gift of humour and of picturesque simile which makes the various journeys very vivid. A special word should be added about the last chapter, "Retrospect," in which he reviews the motives for an expedition such as this, and considers among other things the reactions of a man to his companions whether of the same upbringing and education or not. This is an extremely good piece of writing which will be appreciated by travellers generally. The book itself should be enjoyed by many types of reader, and perhaps not least by younger men, and boys also; and they will not fail to envy Scott his opportunity of having been Watkins' closest friend in the training year which was the prelude to his great expedition. J. M. W.

CENTRAL AND SOUTH AMERICA

INDIAN AIR. By PAUL MORAND. Translated by DESMOND FLOWER. *London: Cassell & Co.* 1933. $7\frac{1}{2} \times 5$ *inches;* 236 *pages; sketch-maps.* 6*s*

Short chapters and a flexible style convey an impression of the speed of the journey by aeroplane over the most spectacular parts of South America which the author obviously enjoyed. When reading this book one can almost imagine Monsieur Paul Morand sitting comfortably in the opposite arm-chair and relating, with a happy knack of painting an attractive word-picture by picking out interesting details and apt contrasts, his own impressions. He is a keen

observer and, when on the ground, he fittingly abandons his broad panoramas in favour of rapid sketches. A clever artist, he gives no more than the essential details, but every picture lives. Two of his best chapters are IV and VIII: the reader feels what he felt when he watched *gauchos* branding colts or heard a voice from Europe through the transatlantic telephone.

Because he gets many of his effects by means of comparisons as well as contrasts, similes are frequent. This is essential to the palette he uses, but it sometimes makes one feel that he is striving to show how widely he has travelled. He describes his subject from an unusual point of view; there are some stimulating ideas and most chapters leave a crisp impression.

AUSTRALASIA AND PACIFIC

AUSTRALIA IN THE WORLD DEPRESSION. By E. RONALD WALKER. *London: P. S. King & Son* 1933. 9×5½ *inches;* xii+220 *pages.* 10*s* 6*d*

The economic life of the Australian Commonwealth, comparatively simple in its structure and presenting boldly marked salient features, provides useful working ground for the economist equipped with the latest methods of research and analysis. Dr. Walker, surveying the Australian economic situation at a later date than did Dr. Benham, has confined himself to the period of the Depression with its antecedents, and his book, though considerably less comprehensive in scope, is in several ways complementary to the latter's 'Prosperity of Australia,' published in 1928.

Dr. Walker's book is an essay in applied economics; his main purpose is to interpret the succession of events; he reveals the complex working of the factors that have contributed to given results, and he attempts to sift out the sound from the unsound views in the public discussion of affairs; he reaches conclusions by the paths of economic analysis as to the causes that have led to realized happenings, but he cannot venture more than tentative prophecies as to the future, since that will be determined by the interplay of various at present uncertain factors, among which the course of wool prices appears to be one of the most potent. The essay shows a skilful handling of the material, and contains numerous striking observations and pointed conclusions. The chapter entitled "Some Theoretical Problems associated with Policy" will prove rather difficult reading to any not versed in current economic writings, but its inclusion is perhaps justified inasmuch as it embodies an interesting assault upon wage-cuts as a direct aid to recovery from depression. The other six chapters give a reasonably clear and impartial exposition of the depression in Australia and illustrate admirably how necessary are careful inquiry and hard thinking as preliminaries to the framing of policies for national economic affairs. E. W. S.

CARTOGRAPHY

THE ASTROLABES OF THE WORLD. By ROBERT T. GUNTHER. *Oxford: University Press* 1932. 12×9 *inches.* Vol. I. The Eastern Astrolabes. xviii, iv+304 *pages.* Vol. II. The Western Astrolabes. viii+305–610 *pages; illustrations.* £10 10*s*

Those who have been privileged to examine the Lewis Evans Collection of scientific instruments under the guidance of the Curator will recall that Dr. Gunther has always taken a very special pride in the finely constructed and exquisitely ornamented astrolabes which form so valuable a part of the collection. He has devoted to them many years of laborious research in which he has had the assistance upon special problems of a number of noted scholars, including

Professor Margoliouth and the late Mrs. Margoliouth. The result is two noble volumes which form, in effect, a catalogue *raisonnée* of the Astrolabes of the World. As the author says in his Preface: "The Microscope alone among elaborate historical scientific instruments can compete with [the Astrolabe] in its accumulated utility," but the astrolabe has a history running back for some two thousand years, as against the mere three centuries of the microscope. Moreover it was the astrolabe which in the service of the astrologer-astronomer kept the spark of science alive through the Dark Ages. Since geography is a daughter science of astronomy, and since to the astrolabe we owe the map net, the beginnings of triangulation, and the beginnings of accurate navigation, Dr. Gunther's treatise should receive the careful attention, not only of mathematicians and students of the history of exact science, but of geographers, some of whom are only too apt to neglect the historic past and to be impatient of the instrument of precision. Nor are these volumes without their appeal to the general reader of cultivated tastes, for in a series of magnificent plates, over one hundred and fifty in all, not only is the development of the astrolabe portrayed, but a remarkable picture is given of fine craftsmanship in metal work through the ages. The designing of the rete or spider, and of the *armilla fixa* or throne of the instrument, gave the artist full scope, and we may compare the delightful running curves of the fifteenth-century Persian example in Plate XXIX with the more sober but dignified and satisfying treatment of a Nuremberg model of about the same date. Or again, the lovely flower tracery of the Indian astrolabe (No. 75) may be contrasted with the delicate geometrical design of the instrument signed by Regner Arsenius, nephew of Gemma Frisius (No. 230). This last has an interesting history, for it was once in the possession of Sir Christopher Hatton, who was accustomed to consult the astrologer John Dee, himself the first to bring to England instruments of his friend Gemma Frisius's making or design.

In addition to cataloguing, classifying, describing, and picturing more than three hundred astrolabes, Dr. Gunther has reprinted in facsimile Morley's important monograph on the subject which appeared in 1856, and has further added several important early treatises, two of which are here rendered into English for the first time. Geoffrey Chaucer's treatise, the most famous, and perhaps the most valuable of all, is not included, for, as will be remembered, it already forms Vol. 5 of the author's series 'Early Science in Oxford.' The oldest exposition extant is that of Philopon, dated *c.* 625 A.D., in which the writer refers to an earlier treatise by his Master Ammonius, which his friends have begged him to elucidate. More helpful however to the modern reader is the longer and more clearly written treatise of Sabokt the Syrian, written perhaps twenty-five years later. Sabokt's references to Ptolemy remind us that in the Eastern Empire the tradition of classical scholarship remained unbroken, and in the "Brescia" astrolabe (Fig. 57) it is believed that we have an example of an instrument embodying Greek ideas and unaffected by the Arabian Renaissance of Science of the eighth and ninth centuries. The 'Astrolabes of the World' is indeed a marvellous storehouse of erudition, and among its most useful functions must be the correction of those false notions concerning mediaeval cosmogony which are still current even among historians. E. G. R. T.

GENERAL

EXPLORERS ALL! By CLIFFORD COLLINSON. *London: Hutchinson & Co.* 1933. 9×5½ *inches; 286 pages; illustrations and sketch-maps.* 8*s* 6*d*

'Explorers All!' is another of those anthologies of travellers' tales that have recently become popular, and there is little doubt that they are read by many

who have neither the inclination nor the leisure to peruse more erudite works. In Mr. Collinson such persons have an entertaining guide; he seems thoroughly to enjoy telling a good tale and there is hardly a dull moment in the recital. His heroes for the most part are well chosen, though Hans Staden seems to have been included more for his adventures among the cannibals, for whom the author seems to have a special predilection, than for his efforts in geographical research. And one might have expected in a book destined for the British public the inclusion of one of the Australian pioneers. Otherwise the choice is excellent and world-wide.

The series makes a brave beginning with the Vikings, who have not always received their due as explorers, and the three sources of information regarding their discovery of America are given at some length. A condensed edition of the travels of Marco Polo follows, and there are lively descriptions of the capture of Montezuma by Cortes and the somewhat similar episode when Pizarro seized the Inca of Peru. Magellan has his rightful place of honour, and one would naturally expect our courageous pirate-hero, Drake, to find a place on the pages. The audacities of the *Golden Hind* make good reading. Mr. Collinson is particularly happy in the choice of his last two explorers. Both are really worthy of the name. Mungo Park's daring adventures alone in the heart of Africa, and Nansen's thrilling exploits during his three years in the Arctic regions should never be forgotten.

There appear to be no serious inaccuracies. At the end of each chapter a list of the books the author has consulted is printed, and there are some good illustrations, chiefly taken from contemporary prints. The easy and vivid style in which the book is written should prove popular and at the same time disseminate much useful information. A. W. S.

GRUNDZÜGE DER ALLGEMEINEN GEOGRAPHIE. By ALFRED PHILIPPSON. Second Edition. Band I. Einleitung—Mathematische Geographie—Atmosphärenkunde. *Leipzig: Akademische Verlagsgesellschaft* 1933. $9\frac{1}{2} \times 6$ *inches;* x+380 *pages; diagrams and maps.* *M.*15.80 (*bound*); 14.50 (*unbound*)

The second edition of the first volume of Philippson's well-known text-book, while in its essence the same as the first edition, has been considerably amplified in some respects. Apart from a brief historical introduction, the book is divided into two parts, dealing respectively with mathematical geography and general physical geography.

Under the heading of mathematical geography, Philippson discusses, in sufficient detail for the geographical student, the form and physical features of the Earth, position-finding on the Earth's surface, and the different projections used for the representation of the Earth's surface on a plane. These subjects are not discussed in exhaustive detail, but sufficient account is given of the topics mentioned to meet the needs of the student. The chapter on map projections, which was written by Dr. Müller-Miny, gives a brief account of a very large number of projections, and is clearly illustrated by suitable diagrams. An author writing on the topics discussed under mathematical geography has no wide choice of the material to be discussed, and the merit of the work before us is that the discussion is clear and easy to read.

Under the heading of general physical geography, discussed in the last part of the book, the author has rather more latitude of choice. Philippson devotes this part to the physics of the atmosphere, or in other words, meteorology and climatology. To these two aspects of the Earth and its atmosphere the author devotes 164 pages and 43 pages respectively. After describing the constitution

of the atmosphere, he discusses the distribution of incoming solar radiation and its influence on the distribution of temperature over the Earth's surface. The differences in type of diurnal and annual variation in different parts of the world are clearly brought out, attention being drawn to the effects of ocean and continent in producing these differences. The general circulation of the atmosphere is described briefly, and the author wisely refrains from any elaborate discussion of so-called theories of the general circulation. Then follows a description of the diurnal and annual distribution of different forms of precipitation and of what are sometimes known as the secondary circulations. In the latter category we find the depression of middle latitudes, and here the author gives an account of the "polar front," and its association with the depression. The diagram of the typical "polar front depression" is rather out of date and does not represent modern views of the direction of motion of the depression.

The section on climatology discusses the division of the Earth into climatic types, and climatic provinces, taking account of the effects of land and sea and of elevation of land. The classification of the whole of the globe into climatic zones is necessarily brief in the space available, but is nevertheless clearly stated. The volume ends with a short discussion of the variations of climate in the past, a discussion too short to give the reader a definite grasp of the present state of our knowledge of this difficult aspect of climatology, whose difficulty is mainly due to the doubt as to what are to be regarded as established facts.

The bibliography at the end of the book, covering eighteen pages, is in the main restricted to continental authors, and contains very few references to English sources. The general impression which the book gives is that it is a workmanlike achievement which should be of considerable value to university students of geography, particularly in conjunction with lectures on the topics discussed. D. B.

THE LIFE OF SIR ERNEST SHACKLETON, C.V.O. By HUGH ROBERT MILL. *London: William Heinemann* 1933. 9×5½ *inches*; 312 *pages*; *illustrations and maps*. 5*s*

When Dr. Mill's authoritative 'Life of Sir Ernest Shackleton' first appeared in 1923, our reviewer, in the course of a long and appreciative notice (vol. 62, p. 40), spoke of the book as a success "alike as a study of character and as a record of achievement"; in his opinion Shackleton had "once more been favoured by fortune in his biographer. . . . It is to the credit of Dr. Mill that so true a record of Shackleton's has been written without the occurrence of a single sentence that could legitimately give pain to any adherent of his rivals in exploration or his surbordinates." We therefore welcome the publication of a cheap edition, which retains all the original illustrations and maps, and should succeed in making this story of an inspiring life available to a wider public than it has hitherto been able to reach.

LETTERS AND DIARIES OF A. F. R. WOLLASTON. Selected and edited by MARY WOLLASTON. With a preface by Sir HENRY NEWBOLT. *Cambridge: University Press* 1933. 9×5½ *inches;* xiv+262 *pages; portraits*. 12*s* 6*d*

The publication of these letters and diaries, eagerly desired by Sandy Wollaston's many friends, should appeal to a wide circle of readers. They do not lend themselves to review in the ordinary manner. The writer of this notice was a friend of the author and familiar with his interests, activities, and all his published writings. Yet the present volume strikes quite a new note. The editor has refrained from republishing anything already in print, with the exception (p. 154) of Wollaston's contribution to the discussion of a paper on New Guinea

at the R.G.S. in 1920: a most fitting exception to her rule, because it emphasizes Wollaston's sympathy with primitive man, and is a contradiction of the suggestion of impatience which naturally and inevitably finds expression in any traveller's diary on many occasions, while his real patience can only be inferred by those familiar with the trials of travel in primitive surroundings. Wollaston was a remarkably "aware" man, but his own personal reticence made him very hard to know intimately. His friends will be very grateful to the editor for the insertion of those few letters to M. M., while wishing that there were more of them: for in them we see the man's feelings expressed in a way that he never permitted himself before any one else.

Wollaston was a realist. His diaries and letters are brief and to the point. All those little details and aspects of travel, so often omitted in the published record, shed a new light on his journeys. The widest appeal will be to the true naturalist: birds, plants, insects, animals—nothing seems to escape him. For the mountaineer also there are many points of interest: his remarks (p. 239) on the necessity of trying Everest before and not after the monsoon are very illuminating. For the traveller and explorer there is much that is quite new, especially in the New Guinea and the Everest sections of the volume. For the general reader the chapter on his war service afloat and in East Africa is extremely interesting—though he was over censorious of himself and we could wish for more detail in many passages.

Perhaps the volume can best be described as a series of vivid sketches of travel, frequently in regions quite unknown. The unusual degree of hardship involved in most of his expeditions is well brought out, but by no means in a complaining spirit, merely truthfully according to the facts. Wollaston was far more intolerant of the troublesome constraints of civilized life. It is difficult to think of any comparable printed record—unless perhaps some of those of the early explorers of Africa—and these had not the variety we find in Wollaston's pages. It is emphatically a book to buy, to read, and to keep. Perhaps the greatest compliment we can pay to the editor is to admit that we should have liked more. The book is admirably produced, and there are only three small misprints.

PRINCIPLES AND PRACTICE OF GEOGRAPHY TEACHING. By H. C. BARNARD. *London: University Tutorial Press* 1933. $7\frac{1}{2} \times 5$ *inches;* xii+234 *pages; sketch-maps and diagrams.* 4*s* 6*d*

This book should be in the hands of every one interested in the teaching of geography. It is full of excellent advice of a really practical kind, based on the author's many years of experience. He discusses what is meant by Geography and how far it can be taught in school: what the teacher has to aim at, and how he is to combine fact-knowledge, geographical reasoning, and geographical imagination. Full references are given to text-books, syllabuses, and methods of teaching. There is throughout a sense of humour combined with a deep understanding of the difficulties which confront teachers of Geography in different types of schools.

A book to be very highly recommended. A. B.

THE MONTHLY RECORD

GEOMORPHOLOGY OF NORTH-EASTERN SIBERIA

An air reconnaissance of the topography and geomorphology of the extreme north-east of Siberia is described by Professor S. Obruchev in *Petermanns Mitteilungen*, 9/10, 1933. The party of four left Krasnoyarsk on 16 July 1932, in a twin-engined Dornier Wal, flying *via* the mouth of the Amur and the shores of the Okhotsk Sea to the settlement on Anadir Bay. Conditions over the Okhotsk sea were very bad, the journey on the Amur-Anadir stage occupying six days. Thence they flew to Cape Dejnev, where they received a radio call for assistance from the settlers on Wrangel Island. These had spent three years on the island, and, as the relief ship could not approach nearer than 50 miles, were threatened with a fourth winter. Though it meant interrupting their scientific work, and fog and snow clouds made flying dangerous, they responded to the appeal, and were successful in carrying eight colonists and 1500 kg. of furs from the island to the relief ship, and in reprovisioning the settlement. The return flight almost ended in disaster on several occasions, notably near Olyutorsk, and in Nagajev Bay. Finally it was necessary to ship the machine to Vladivostok.

From the observations made on this flight, in conjunction with recent research, it has been possible to revise considerably the conception of the geomorphology and tectonic relationships of this area. The article is accompanied by a hypsometrical map compiled by K. Salishchev. The tectonic mountain chain along the Okhotsk Sea is sharply separated from the Gydan range to the north: this rises much more rapidly to 1200 metres than previously represented, and the general level in the interior is about 2000 metres. Observations also tend to show that the Kamchatka mountains are distinct from the continental system. The mountain arc which commences near Korf Bay runs continuously to Cape Navarin: here it ends abruptly, and it is probable that the Anadir river occupies a tectonic trough. Throughout their length these Koryak mountains, a much-dissected group, fall directly to the sea from heights of 800 to 1300 metres.

Lakes were seen in the Anadir river area, which appeared to be bounded on the east by the steep slopes of a young Alpine range, entirely independent of the older Anadir mountains to the north. These Anadir mountains are a considerable massif, which extends from Kolyuchin Bay to the meridian of Chaun Bay. They fall steeply to the north at distances of 15 to 20 kilometres from the coast. The eastern Chukotski peninsula is an extensive, intricate, and highly dissected mountain land, crossed by deep broad valleys, apparently of glacial origin, the most important of which run in a north-westerly direction. There are summits rising over 1000 metres.

This area has been subjected to a previous extensive glaciation. The Chukotski and Koryak coasts are broken by typical fjords, and other evidence of an Alpine glaciation is plentiful. An earlier greater glaciation which covered the foothills of the Anadir valley can also be assumed. The Quaternary glaciation does not appear to have filled completely the valleys of the great rivers. The mouth of the Anadir has only recently emerged from the sea.

HYDRO-ELECTRIC POWER IN MOROCCO

MM. Y. le Moigne and J. Bourcart contribute to the *Revue de Géographie Physique* (1933, pt. I) a study of the possibilities of utilizing the waters of the Umm er Rebia. The régime of the river is not yet known in detail, and it is partly to supply a systematic description for the co-ordination of future projects that this study has been made. There are several prominent steps in the profile

of the Rebia, though all are not suitable for the sites of barrages. In the upper course, the best site is at Imizdelfane, below Khenifra. There, in contrast to the permeable and soluble rocks higher up, a bank of quartzite occupies the river-bed, reducing its width in places to barely 1 metre, and giving a fall of 25 metres in 400 metres. At Khenifra the annual flow is 600 million cubic metres, with a comparatively small variation from 12 cubic metres per second in August to 28 in February. It is suggested that power generated here could be linked with the existing system to supply Meknes and Casablanca. The middle course of the river does not offer facilities for power development, but the river could be used for irrigation. At present, the water has been found to contain too great a salt content, but this can be obviated by removing the salts deposited by periodical flooding, or by mixing the water with that from other sources. It has been decided, in spite of objections, to complete a 25-kilometre canal from the river near Kasba Tadla, which at its terminal hydro-electric station would give a fall of 35 metres. The authors are of opinion that it would be more profitable to use the water for irrigating the Beni Amir plains. There is at present a hydro-electric station working in the lower river at Sidi Said Machou, and future developments must provide for the continuance of its supplies.

GEOLOGICAL HISTORY OF LAKE KIVU

The theory that the waters of Lake Kivu formerly flowed northwards, which was first brought forward by Professor A. Salée, receives further confirmation in a paper by N. Boutakoff in the *Bulletin* of the Belgian Geological Society (fasc. i, 1933). The primitive level of Lake Tanganyika, as evidenced by fossil terraces, stood at 1280 metres, compared with the present figure of 773 metres. At the former level, the lake would fill the present valley of the lower Ruzizi: that this was so has been established by the discovery of very ancient lacustrine deposits near Luvingi at the extreme northern end of the Tanganyika–lower Ruzizi trough. The great outpourings of lava to the south of Lake Kivu filled a wide valley, which must have been the connecting link between the former Tanganyika and the Kivu hydrographical system, since its lower level was well below 1290 metres.

It remains to show whether these southern lava streams, or the more recent Virunga flows, dammed the Kivu system and caused the inundation; also to determine whether Kivu flowed into Tanganyika, or the reverse. If the old hydrographical system of Kivu is examined, it will be found that 90 per cent. of the valleys run northwards. The presence of islands in the southern, but not in the northern, half of the lake, shows that the original *Thalweg* was lower in the north. If there had been a deep valley west of Idjwi, one would not expect the lava flow to have reached the island. The Kivu system therefore flowed northwards, and it was the waters of Lake Tanganyika that were dammed up by the lava, as the existence of terraces, from 340 to 510 metres above present lake-level show. The comparatively recent sinking of the Tanganyika trough dislocated the basalt flows. The Virunga barrier produced Lake Kivu.

In the same number, M. Boutakoff describes the two volcanic massifs of Kahusi and Biega, which he shows to be the centres of emission, previously unlocated, of the basalt flows south of Lake Kivu.

THE DISCOVERY OF THE COLUMBIA RIVER

Who discovered the Columbia River? Mr. J. Neilson Barry, secretary of the Research Council of Portland, Oregon, has devoted much time and energy to investigating the geographical problem whether what in 1792 was taken as the mouth of the Columbia River was at the ocean or at Skamokawa, some 28 miles

from the sea, where the river widened out to a breadth of from 3 to 7 miles and received the waters of several important tributaries; and Mr. Barry's opinion is that on this point hinges the question as to who discovered the Columbia River. The Society has received from him an article on this subject, with charts and illustrations.

Mr. Barry has done much towards elucidating how much Bruno Heceta, the Spanish naval officer, observed when he came off the inlet, which for a time bore his name, on 17 August 1775. Spain recently permitted the Library of Congress to have a copy of Heceta's chart from the Archivo General de Indies at Seville, and working on a copy of this copy Mr. Barry has succeeded in fixing the position of Heceta when he took his bearings, and also in identifying the points on the chart with the present-day features. Another fresh source of information that Mr. Barry has been able to draw on is the Journal of an officer (presumably Edward Bell, clerk) of H.M.S. *Chatham*, the tender to Vancouver's ship, the *Discovery*, from 12 October to 22 November 1792: this period includes the crossing of the bar by the *Chatham*, and Broughton's subsequent survey of the river up to Point Vancouver. This manuscript was found on an old bookstall in London by the late Alexander Turnbull, of Wellington, New Zealand; at his death he bequeathed his Library of over 60,000 volumes to the people of New Zealand; they are now in the Alexander Turnbull Library at Wellington, and through the good offices of the Librarian Mr. Barry was able to obtain a copy.

Broughton undoubtedly was of opinion that the mouth of the great river was at Skamokawa, and that the expanse of water between that place and the ocean was an inlet or sound. With this opinion Vancouver did not agree, and in his maps, issued with the history of his voyage, he shows the Columbia River as including the inlet, and in the body of the work he more than once mentions Captain Robert Gray of the *Columbia Rediviva* as the discoverer. Gray crossed the bar on 12 May 1792, and proceeded 16 miles up the inlet, not as far as some of the points Heceta had marked on his chart. Vancouver's dicta were accepted as final.

Mr. Barry's article, illustrations, and charts are preserved in the Library for the use of students and of others interested in the geography of the lower reach of the Columbia River, and our thanks are due to him for his courtesy in sending us the outcome of his many years' examination of the subject. B. R. M.

VEGETATION OF THE VENEZUELAN LLANOS

Though the physical character of the Venezuelan *llanos* is known from the accounts of Humboldt and successive travellers, the vegetation and ecology has yet to be thoroughly investigated. Dr. J. G. Myers describes briefly in the *Journal of Ecology*, August 1933, a journey made by him in the dry season of 1930–31, which afforded material for a first appreciation. He crossed the llanos southwards from near the eastern end of the lake of Valencia to San Fernando on the Apure, passing through Calaboro. This was approximately the route followed by Humboldt and Bonplan in 1800. Humboldt's description of the llanos, which stresses their uniform aspect, gives little information about the constituents of the plant life, and the term "savannah" came to be applied generally. Codazzi seems to have been the first to note many diverse types of savannah within the llanos. The determining characteristics of the llanos from the ecological point of view are their low elevation, a relatively moderate rainfall—but concentrated in the wet season, and a long dry season accompanied by dry north-east winds.

Between the Coastal Cordillera and the Apure river, the dominant type is "bunch grass savannah" with *Cymbopogon rufus* over large areas. The trees,

apart from the fringing forests of the river banks, vary from nil to a fair density of the orchard type, the chief species being *Curatella americana* and *Bowdichia virgilioides;* Llanera palms vary in the same way. Along the rivers Apure and Portuguesa there extends a belt, varying in width, of true "high grass savannah," depending upon the deep annual flooding. The damper depressions scattered over the llanos have a zonal vegetation of their own. The upland savannahs of British Guiana are of the "bunch grass" type, resembling the llanos, being similar in climatic origin, but differing in topography. Dr. Myers does not attach much importance to the idea that fires enable savannah to encroach on forest. Selective feeding by the great herds of horses and cattle has influenced the plant composition, and has led in many places to deterioration of the pasture. This influence is much less in the river belts.

SEA CONDITIONS IN BARRIER REEF REGION

A discussion by Mr. A. P. Orr on "Physical and Chemical Conditions in the Sea in the Neighbourhood of the Great Barrier Reef" forms No. 3 of Volume II of the "Scientific Reports of the Great Barrier Reef Expedition, 1928–29, published by the British Museum (Natural History)." The Report comprises observations by seasonal variations made at a position 3 miles east of Low Isles, conditions in different parts of the Barrief Reef lagoon or the sheltered water inside the Barrier, and also close to and beyond the Barrier, together with a comparison of the Barrier Reef region with other localities. The lagoon, which has an average surface temperature of 25·6° C. in the neighbourhood of Low Isles, is subject for the greater part of the year to the south-east trade which causes a northward current and keeps the water well mixed from top to bottom. During the remainder of the year between November and March the wind is lighter and more variable, and there is heavy rain with frequent thunderstorms. It is an interesting coincidence that the greatest depths in the lagoon, about 50 metres, are approximately those to which vertical mixing takes place in the open sea outside the Barrier. The top 50 metres were found to be essentially similar physically and chemically within and without the Barrier; but between 50 and 100 metres outside an abrupt change took place in all the conditions. Thus temperature fell, salinity rose, p_H value and oxygen saturation fell, while phosphate and nitrate rose, the discontinuity layer being found at the same depth in the rainy and dry seasons. The existence throughout the year of a discontinuity layer between 50 and 100 metres in the deeper water of the Barrier Reef region constitutes a very important difference between such tropical waters and the sea in temperate regions. In the Barrier Reef region the winter cooling of the water is never sufficient to mix it deeper than 50 metres, so that plant nutrient salts cannot be reintroduced from the deeper layers; whereas in temperate waters the winter cooling extends much deeper than the photosynthetic zone, and fresh supplies of salts are introduced into the surface waters.

With the aid of graphs comparison is made between the seasonal variations as observed in the lagoon near Low Isles and those in the comparatively enclosed waters of the English Channel. The much cooler waters of the Channel are richer in plant nutrient salts, and a striking difference is the greater tendency to layering or stratification of the water in connection with the seasonal changes. In the spring nutrient salts are rapidly used up by phytoplankton in the warming surface water of the Channel, and are regenerated in deeper water by decomposition or by zooplankton, and in the autumn the cooling surface water leads to mixing of the strata and replenishment of the surface with nutrient salts.

THE BLOSSEVILLE COAST, EAST GREENLAND

In the *Journal* for May 1933 Captain Ejnar Mikkelsen contributed a paper on the Scoresby Sound Committee's Second East Greenland Expedition to King Christian IX's Land in 1932. He has now published a more detailed account of the work done in *Meddelelser om Grønland* (Bd. 104, No. 1, pp. 1–71). The following notes must be taken as complementary to the first paper.

The expedition had for its chief object the erection of a number of huts at suitable places along the coast, to constitute a connection between the two East Greenland settlements at Angmagssalik and Scoresby Sound, thus making it possible for the Greenlanders to travel from one settlement to the other. It was a hard task, as this stretch of coast is one of the most difficult to approach in the whole of East Greenland and the scheme also included a thorough investigation of the country traversed, which, from a scientific point of view, was a *terra nova*. A topographical survey was undertaken along the coast-line between Cape Dalton and Angmagssalik, connecting up on the south side with the work of the British Arctic Air Route Expedition in 1930, and in the north with that of J. P. Koch in 1900.

The expedition reached the coast at Cape Dalton on July 10. The depot house of the Amdrup Expedition had suffered a good deal from exposure, and was also found to have been broken into and a number of articles removed, probably by sealers. This discovery is disquieting in that it is no longer possible to leave provisions and equipment on the east coast of Greenland, and trust to such depots being considered inviolable. The house was repaired and restocked with fuel and provisions to form the first of the projected series. Further huts were erected at Cape Daussy, Mikis Fjord, Uttental Sound, and Tugtilik (Lake Fjord). All these places had good anchorages, and were chosen because of the areas of comparatively level and ice-free land close to the shore. Two huts were put up in Uttental Sound to enable the Greenlanders to take advantage of the excellent hunting conditions there, and at all of them a small quantity of fuel and provisions were deposited.

A large number of soundings were made in the different fjords visited by the expedition, and the information collected on safe anchorages and shelters from ice pressure will be most valuable to future ships navigating this coast. The fjords into which rivers flowed were found to be the safest harbours owing to the outflow of fresh water which keeps the drifting ice away from the shore. There has been a definite recession of most of the coastal glaciers since Amdrup's Expedition in 1900. In a bay between Cape Rink and Cape Normann, where thirty-two years before Amdrup had seen a number of local glaciers joining to form a small glacier at the head of the fjord, a gently sloping and almost ice-free valley region was found.

The biological reports of the expedition have not yet been published. The chief result appears to be the discovery of a sharp boundary line between the flora and fauna of south and north-east Greenland in lat. 68° 30′–50′. Excavations of old Eskimo settlements were undertaken in Mikis Fjord and Uttental Sound, while the other work was being carried out. The cartographical work of the expedition will be published later, and only a small-scale outline map of the coast from Kangerdlugsuak to Cape Dalton is included with the published report.

The final port of call was the Angmagssalik settlement, which was reached on September 4. Here the Greenlanders were informed of what had been done for them at a meeting of some two hundred natives. They were encouraged to make use of the facilities to travel northwards, and it is hoped that by this means the hunting congestion at Angmagssalik may to some extent be relieved.

FORMATION OF STRAITS

The general aspects of the formation of sea straits has not yet received a large amount of attention. As part of a more extended study, T. Vater publishes in the *Mitteilungen* of the Geographical Society for Thüringia (vol. 40) some preliminary considerations. Previous classifications, largely due to Professors Penck and Krümmel, have distinguished four main types, caused by subsidence, elevation, ingression of the sea, and erosion. In this paper the writer concentrates upon the latter types, where river erosion and continental oscillations have combined to produce the present configuration. These contrast with the Mediterranean type of strait, where a narrow land bridge, created by faulting and elevation, has been broken by tectonic forces, causing the local relief to be mainly determined by the geology. The three examples he examines in detail are the Danish straits, where the Great Belt is regarded as a primitive river valley of post-glacial age, which flowed from the "Ancylus" inland sea, and to which the Little Belt and the Sund were tributary; the Bosphorus and Dardanelles; and the Straits of Dover.

For the Bosphorus, he attempts to reconcile conflicting views by separating the history of the main valley from that of the stream channels. He supports Philippson's view of the Dardanelles as a product of river erosion. He also synthesizes the views on the Straits of Dover, emphasizing the role of the "Lobourg river" in preparing the path for tidal action. Papers on the age of these straits by Professors Gregory and Stamp appeared in the *Journal* for July and October, 1927.

ANCIENT SYSTEMS OF EARTH-PARTITION

The varying ideas of the ancients as to the division of the Earth's surface into its main portions are conveniently summarized by Dr. R. Uhden in the *Geographische Zeitschrift*, Heft 5, 1933. While there is no indication that the question received attention among Eastern peoples, it was a subject of discussion among the Greeks from the earliest times, consonantly with their general advance in geographical theory, which reached its climax in Posidonius, but then began to decline. The Greek word ἤπειρος, used for the great units of the Inhabited World, originally had the sense of an area extending indefinitely into the unknown, but by Homer's time had begun to be used for mainland as distinct from islands. The corresponding Latin word *continens* stressed rather the idea of unbroken extension, and it was so understood in early modern times. The tripartite division of the Ionian Greeks (adopted, though with some demur, by Herodotus) had a more or less practical basis, as it corresponded to the three main terminals of voyages from the Aegean, the lines of division being at first the Nile and the Phasis, though with increasing knowledge the latter was replaced by the Maeotis and the Tanais. Whether the rivers in question were considered to make actual islands of the three land-masses (in the strict sense of the term) cannot be definitely decided. Side by side with this was a division by isthmuses, the land between the Black Sea and the Caspian being so regarded under the idea that the latter was a gulf of the ocean.

The other main system—a division into two—was rather theoretical than practical, being based chiefly on the different character of the north and the south, and its earliest champion was apparently Anaximander, whose views were adopted later by Dicaearchus and Eratosthenes. Still another mode of division, more fully discussed by Dr. Uhden in *Petermanns Mitteilungen*, Heft 7/8, 1933, seems to have been that by a north and south line through Delos, treated as the hub of the circular Earth, which originated in the very early times when the known world embraced little more than the lands east and

west of the Aegean. The extended use of the terms Europe, Asia, and Libya came in at a later date. After the Ionian philosophers the question was allowed to drop until reopened on a new basis by Dicaearchus and his followers, who discarded natural conditions and adopted a purely mathematical and arbitrary division by sectors or many-sided figures. Those who realized its uselessness for practical purposes were forced back to the early tripartite division; the Stoic philosopher Posidonius (second century B.C.) having sought in vain to work out a system of natural regions based on climate, flora and fauna, which it proved impossible to harmonize with the conditions of human life. To Strabo belongs the merit of being the first to apply the comparative method to the continents, on the basis of differences in form and physical conditions. The Roman geographers followed in the main the old threefold division by the Nile and Tanais, though it could not hold for their detailed regional descriptions. The writer ends by pointing out the impossibility of compromise between theoretic and practical considerations in such a question, and the fallacy of thinking the threefold division to have had any real scientific foundation.

DISPERSAL OF AN OLD CONTINENTAL LIBRARY

All friends of old libraries will have heard with regret of the sale by auction, on November 21 and 22, of one of the most remarkable old continental libraries that have remained intact down to our own time. This is the library of Prince Dietrichstein, at Schloss Nikolsburg in Moravia, which is of interest both for its history and for the large number of *incunabula* and other rarities, many of them of high interest to geographers, which it contained. Through the courtesy of Messrs. Maggs we have received a copy of the illustrated sale catalogue, produced in excellent style by the well-known firm of auctioneers at Lucerne, Messrs. Gilhofer and Ranschburg, and systematically arranged under the very varied classes of books and manuscripts represented; there are copious indexes of authors and subjects as well as a special list of *incunabula* with references to the standard works in which they are described, the whole being prefaced by a sketch of the history of the library. This in itself has an interest to geographers from the fact that the earliest nucleus was formed in the time of Columbus by the Nürnberg humanist and physician, Hieronymus Münzer (latinized as "Monetarius"), friend of the chronicler Hartmann Schedel and patron of Martin Behaim; Münzer's name is known to students of early discovery from the letter written by him in 1493 to King João II of Portugal urging that sovereign to undertake a western enterprise similar to that of Columbus of the previous year, and recommending Behaim as a man competent to take a leading part in it. It appears to have been due to Behaim's influence that Münzer undertook his journey to Spain and Portugal in 1494–5, during which some of his *incunabula* were secured, as witnessed by the inscription "in peregrinatione hispanica." The original collection was largely added to by Münzer's heir, Hieronymus Holzschuher, friend of Albrecht Dürer, and was subsequently acquired as a whole by the great sixteenth-century bibliophile Ferdinand Hoffman, to whom the formation of the library in its complete state was mainly due, its contents numbering over 10,000 volumes at his death in 1607. It was not till 1667 that the library came to its final home, by gift to Prince Ferdinand von Dietrichstein, great-nephew of the famous Cardinal; for the great collection made by the latter at Schloss Nikolsburg had been seized in 1645 by the Swedes under Torstenton and sent to Stockholm to Queen Christina.

Of the twenty-three classes into which the books are grouped, the first covers geography, navigation, etc., and the fifty-two items include some interesting rarities, only a few of which can be specified. One is the autograph MS. (sup-

posed to have been lost) of the description of Swabia and Ulm by the celebrated pilgrim to Jerusalem, Felix Fabri. Another, a contemperary MS. copy of the "Speculum Orbis" of Walther Lud, of St. Dié, of the printed edition of which (1507) only one copy seems to be known. Of special interest is a previously unknown woodcut road-map of the country round Nürnberg, "Dem jungen Wandermann fast nützlich," of circular form, with a minute subsidiary map of the towns round Bamberg. Though much smaller, it recalls the "Romweg" map of 1501 by Etzlaub, and is supposed to be of about 1515. Dutch sea-books are represented by several rare items, including Dutch versions of the Spanish work of Medina, and the English ones of Bourne and Hood; also a fine copy of a practically unknown collection of sea-charts by Willemsen van Hollesloot. The Americana section, though not so extensive, is naturally of geographical interest, a special rarity being the first edition (Milan, 1556) of Girava's 'Dos libros de cosmographia.' (Of this the Society's Library is fortunate in possessing a copy.) The small class of "Helvetica" includes the profusely illustrated chronicle of Johan Stumpf, as well as Tschudi's rare work on "Rhetia," and among the *incunabula*, the rare first edition of Breydenbach's 'Peregrinationes in Terram Sanctam" deserves special mention. The catalogue contains thirty-nine plates, reproducing title-pages, illustrations, pages of illuminated MSS., old bindings, and lastly the fine bookplate of Hoffman, inserted in most of his books.

MEETINGS: SESSION 1933–1934

First Meeting, Afternoon and Evening, 6 November 1933. The President in the Chair

Paper: The Mount Everest Expedition of 1933. By Mr. Hugh Ruttledge. (Repeated at an Additional Evening Meeting on November 8)

First Afternoon Meeting, 13 November 1933. The President in the Chair

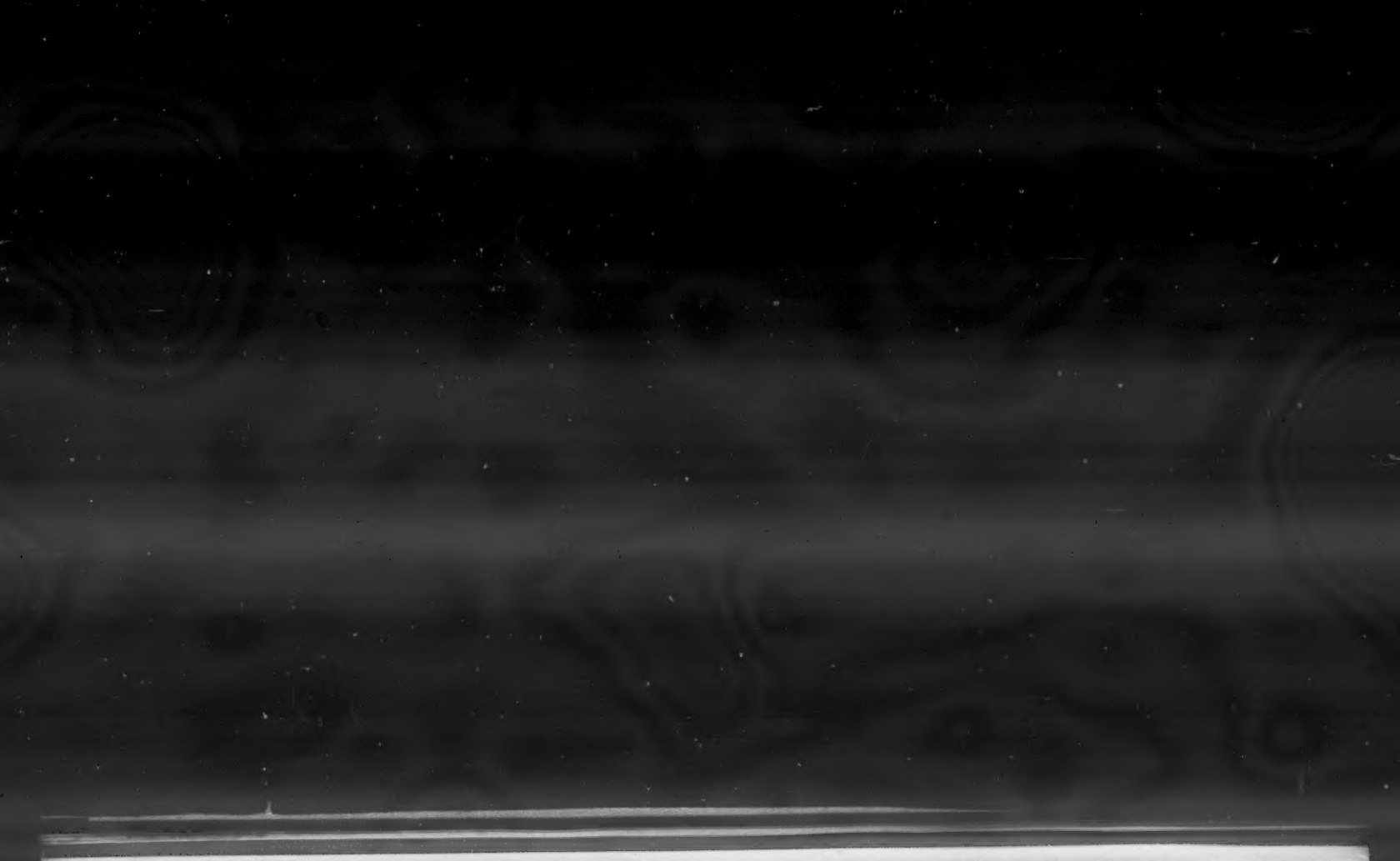
Paper: The Extinct Waterways of the Fens. By Major Gordon Fowler

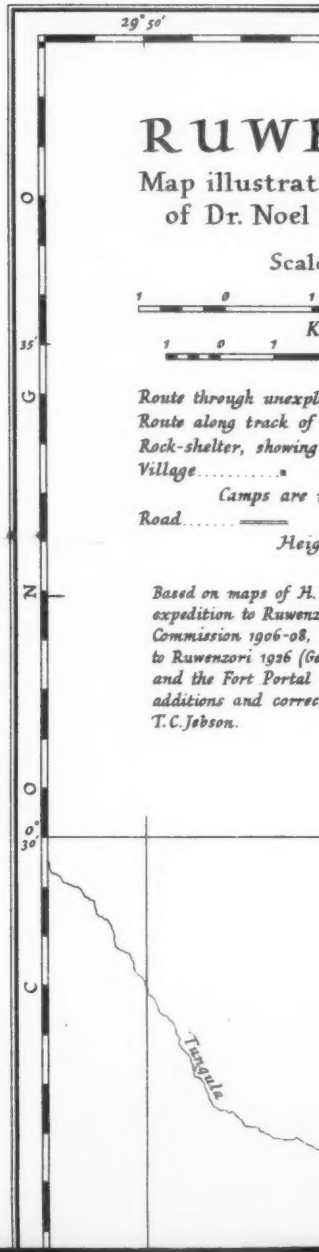
Second Evening Meeting, 20 November 1933. The President in the Chair

Elections: Mrs. Francis Abell; Miss Edith Mary Annand; William John Archer, B.A., B.D.; Capt. R. N. Ashton, F.Z.S., F.R.C.S.; Hugh George Balfour; Harry Barker, B.SC.; Mrs. Edith Barlow; The Rev. Walter Barnsley; Clarence Edward Bartholomew, O.B.E.; Bernard Pawley Barton; George Colin Lawder Bertram; E. G. Bird; Mrs. Sophia Fleming Bland; Eric George Boughton; E. W. H. Briault; John Jeremy Brigg; Mrs. Jocelyn Florence Brock; R. W. Browning; Harold William Burridge; Major John Bush, R.M.; Douglas Busk; Arthur Wiltsee Carpenter; Kumud Chandra Roy Chowdhury, M.A.; John Lockwood Clayton; Joseph Veasy Collier; Miss Ella Compton; Bertram Samuel Cooper; Mrs. James W. Corrigan; Lady Cox, O.B.E.; Miss Rhoda Nelson Dawson; Miss Edith Maud Day, B.A.; The Marquis of Douglas and Clydesdale, M.P.; Capt. William Alexander Doust; William Rostron Duckworth; The Rev. Ernest James Morritt Eldridge, O.B.E.; Marcus Felix Brudenell Fitch; Noel B. Fitz-Henry; Hugh Perceval Ross Foster; Major Gordon Edward Fowler; Mrs. Elizabeth Wilkeson Freeman; Richard Leslie Gair; Mrs. Agnes Gibbs; His Grace the Duke of Grafton; C. Patrick Green; Murray Griffith; Miss Rachael Winifred Haig; Herbert Austen-Hall, F.R.I.B.A.; Miss Phyllis

Milward Harding; Herbert William Harper; Philip Henry Cecil Hayward; Henry Hollas, M.A.; Edward Arthur Hubbard; Capt. Henry Hughes, R.A.R.O., R.E.; Samuel Adams Dulany Hunter, M.S.; H. Hutchinson, B.SC.; Harry Middleton Hyatt, M.A., D.D.; Alfred Cecil Hyde; A. G. Nelson Jones; John Jenkyn Keigwin; Hugh Arthur Neill Keith; John La Page; Capt. William Edward Ladd; John H. G. Lebon, B.SC.; Miss Margaret Allan Linn; Edward Lynam, B.A., M.R.I.A.; H. J. Mackintosh; Flt.-Lieut. D. F. McIntyre, A.A.F.; Prof. James Edward Magee, B.L., A.M., D.C.L.; Mrs. Melsena Enlalia Monica Mardon; Capt. Francis Thomas Mee; K. T. Merchant, M.A., LL.B.; Miss Julia T. Merritt; James H. Monahan; Herbert Money, M.A., PH.D.; Arthur Winston Moore; Miss Florence Gregory Moss; Erling Dekke Naess; Mark Mervyn Leofric Parkinson; Sir Thomas Parkinson; H. E. Pegg; Gerald F. J. Pegler; Miss Winifred Ponder; Miss Molly Poole; Thomas Henry Ratcliffe, A.L.C.M.; Charles Reed, F.S.S., F.R.ECON.S.; Capt. Douglas Lorrain Rees, I.A.; Surg.-Lieut. John Mansel Reese, M.R.C.S., L.R.C.P., R.N.; John Richardson Reynolds, C.I.E.; Percival William Reynolds, M.S.O.P., C.M.Z.S., M.B.O.U.; Miss Georgia Margaret Rhodes; Lieut. Ian Hurry Riches, R.M.; Rodney Sadleir; Sir Edgar Sanders; Oswald Shuffrey; Bertram Alan Sims; Major Harry Sinderson, Pasha, O.B.E., M.V.O.; Sirdarni Harbans Singh, M.R.A.S.; Jacob Myers Singleton; Mrs. Margaret Southam; Dr. W. H. Storm; Mrs. Phyllis Seymour Sundara Raj; The Rev. Herman Swenson; Lt.-Col. Gerald Trevredyn Tait; Miss Giovanna Danyell Tassinari; David Haig-Thomas; Mrs. Eva Hyde-Thomson; James Alexander Tinling, F.C.A., F.Z.S.; Campbell Turner; Miss Jeannette Katherine Gordon Wade; E. L. Walsh; W. G. H. Weeks; Miss Sheila J. Blennerhassett West, B.A.; William John Wheeler, B.A.; Robert Whyte; I. O. Williams, M.A.; Miss Ethel M. Willoughby; Norman Woodhead, M.SC., F.L.S.; Robert H. Wright

Paper: In Afghanistan with the Citroën Trans-Asiatic Expedition. By Monsieur Joseph Hackin





Height	Mt. EMIN
15754	Umberto Peak
15724	Kraepelin Peak
—	Okwetegereza
	Mt. GESSI
15647	Iolanda Peak
15483	Bottego Peak
	DUWONI or Mt. SPEKE
16080	Vittorio Emanuele Peak
15906	Johnston Peak
—	Ensonga
—	Ekyamaino
	Mt. PORTAL
14299	Kihuma
13909	Rutara
—	Hamuguti
	Mt. STANLEY

1WENZORI

llustrating the Expeditions
Dr. Noel Humphreys, 1932

Scale 1/125,000

Miles 0 1 2 3 4

Kilometres 0 1 2 3 4 5 6

rough unexplored country
ng track of previous expeditions
lter, showing orientation
Camp, in the open
Camps are numbered 1 - 57
Path
Heights in feet

maps of H.R.H. the Duke of the Abruzzi's
on to Ruwenzori 1906, the Uganda-Congo
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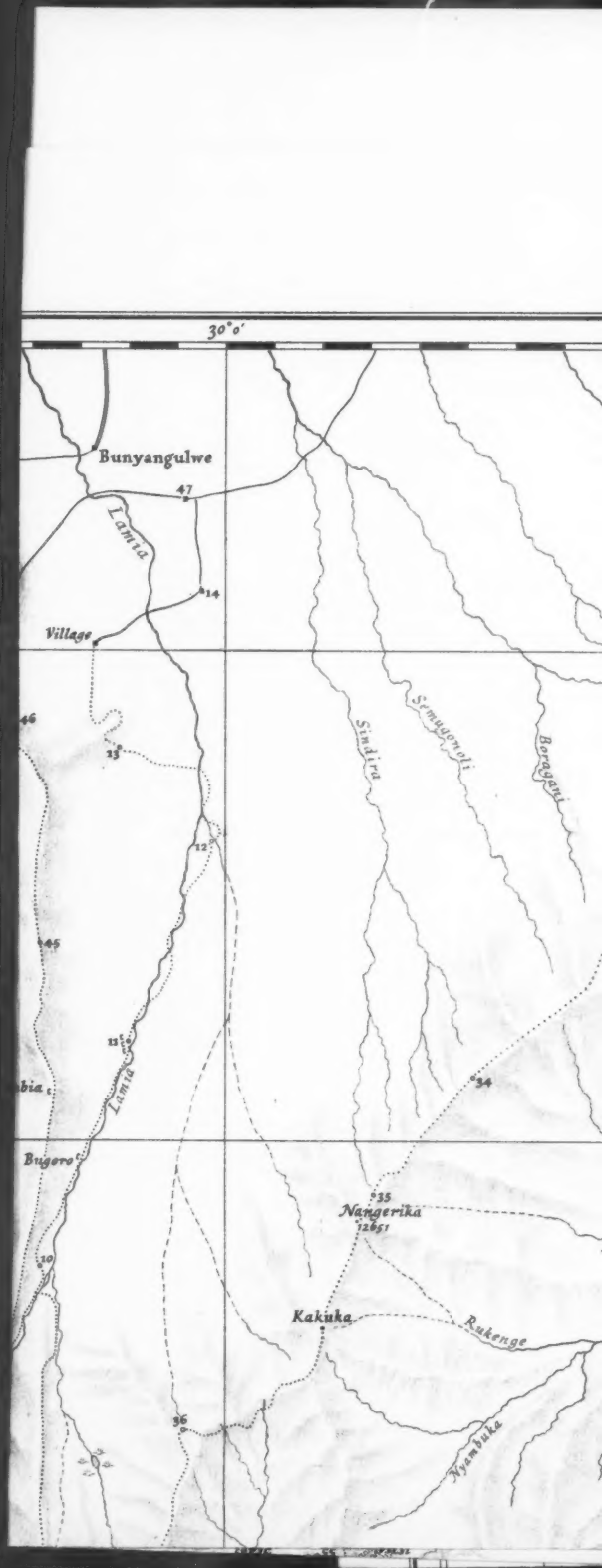
Fort Portal sheet Africa 1/250,000; with
s and corrections by Dr. Humphreys and
on.

55' 30°0'

Bunyangulwe
47
Lamia
14
Village
Kazimba 46
13
12
Ruamgali
45
11
Kirambia
Lamia
Bugoro
10
Ruamiya
Ruamuli
43
44
40
38
39
Kakuka
42
36
Okwetugereza Falls 42
Mt.
Lamia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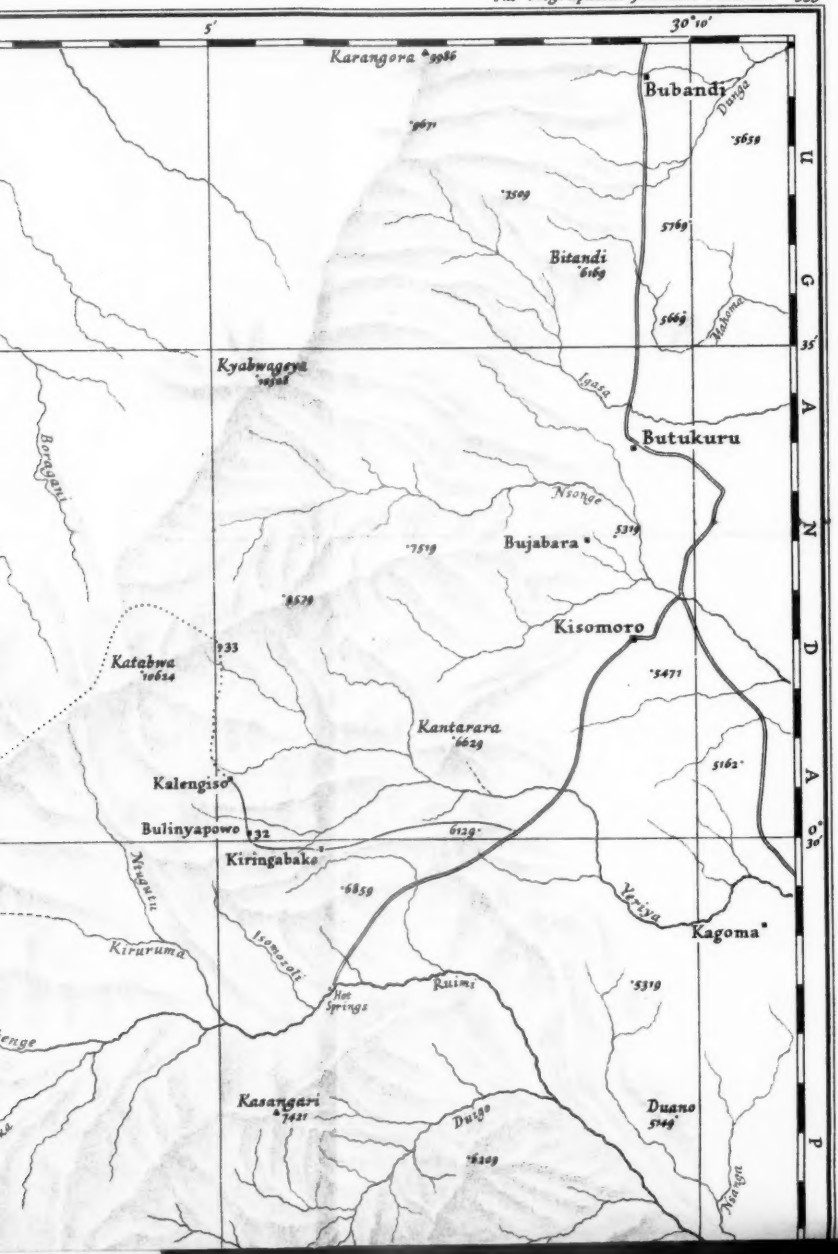
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Mt. PORTAL

14299	Kihuma	
13909	Rutara	
—	Hamuguti	

Mt. STANLEY

16794	Margherita Peak	*Twin Peaks*
16749	Alexandra Peak	
16421	Savoia Peak	
16388	Elena Peak	
16159	Moebius Peak	

KIYANJA or Mt. BAKER

15988	Edward Peak
15843	Semper Peak
15286	Wollaston Peak
15269	Moore Peak
14813	Grauer or King Edward Rock

Mt. LUIGI DI SAVOIA

15163	Weismann Peak
15150	Sella Peak
14923	Stairs Peak

14826	Cagni Peak
14479	Kinyangoma

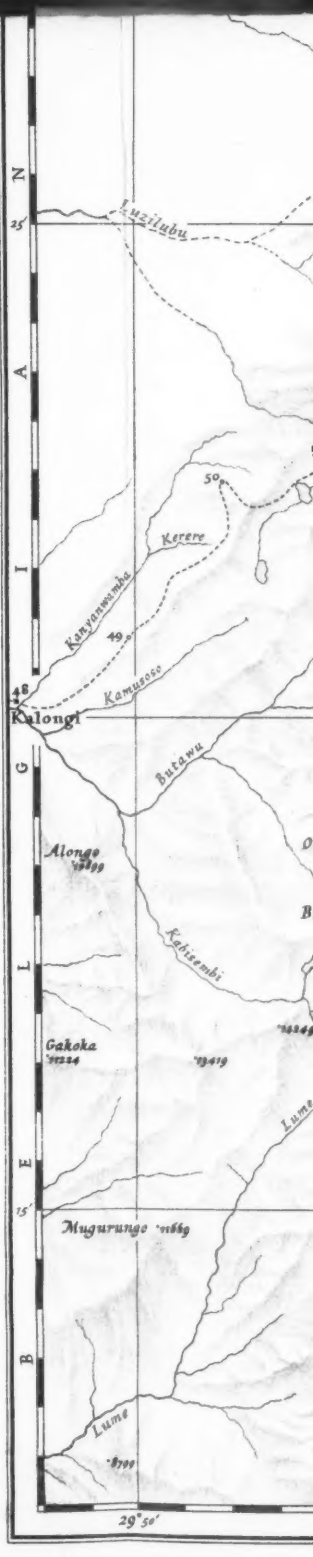
Roccati Pass 14403 ft.
Between Mt. Emin and Mt. Gessi

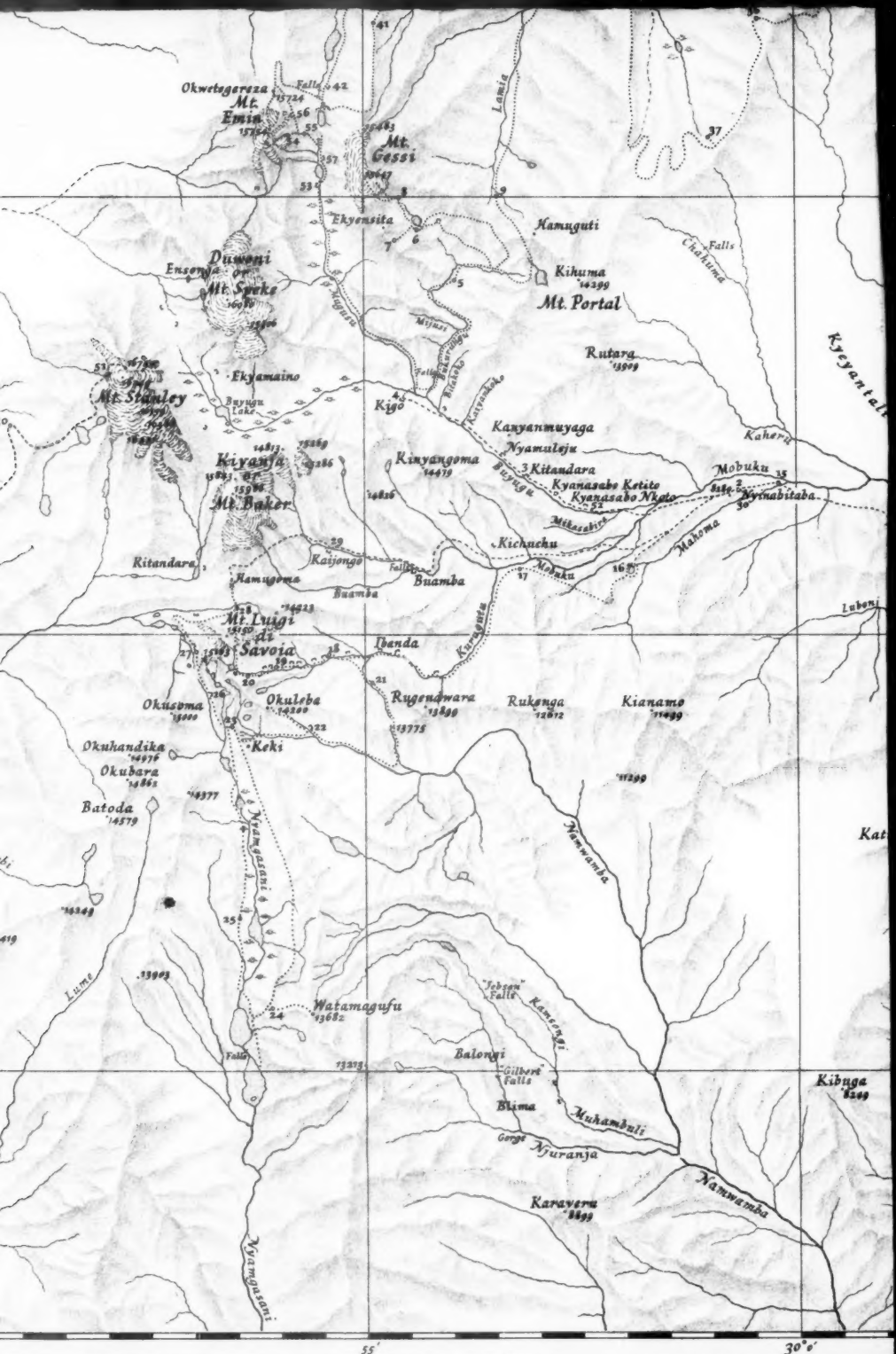
Cavalli Pass 14141 ft.
Between Mt. Emin and Mt. Speke

Stuhlmann Pass 13757 ft.
Between Mt. Speke and Mt. Stanley

Scott-Elliot Pass 14262 ft.
Between Mt. Stanley and Mt. Baker

Hamugoma 14403 ft.
Between Mt. Baker and Mt. Luigi di Savoia





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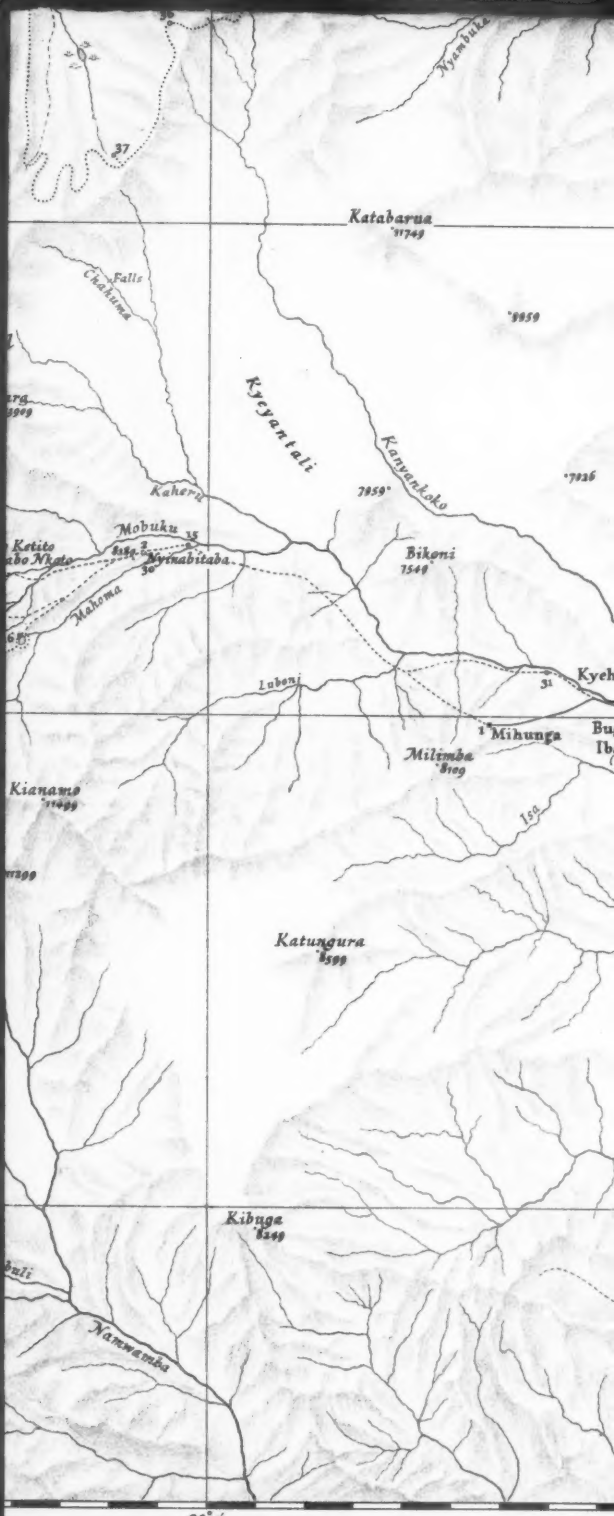

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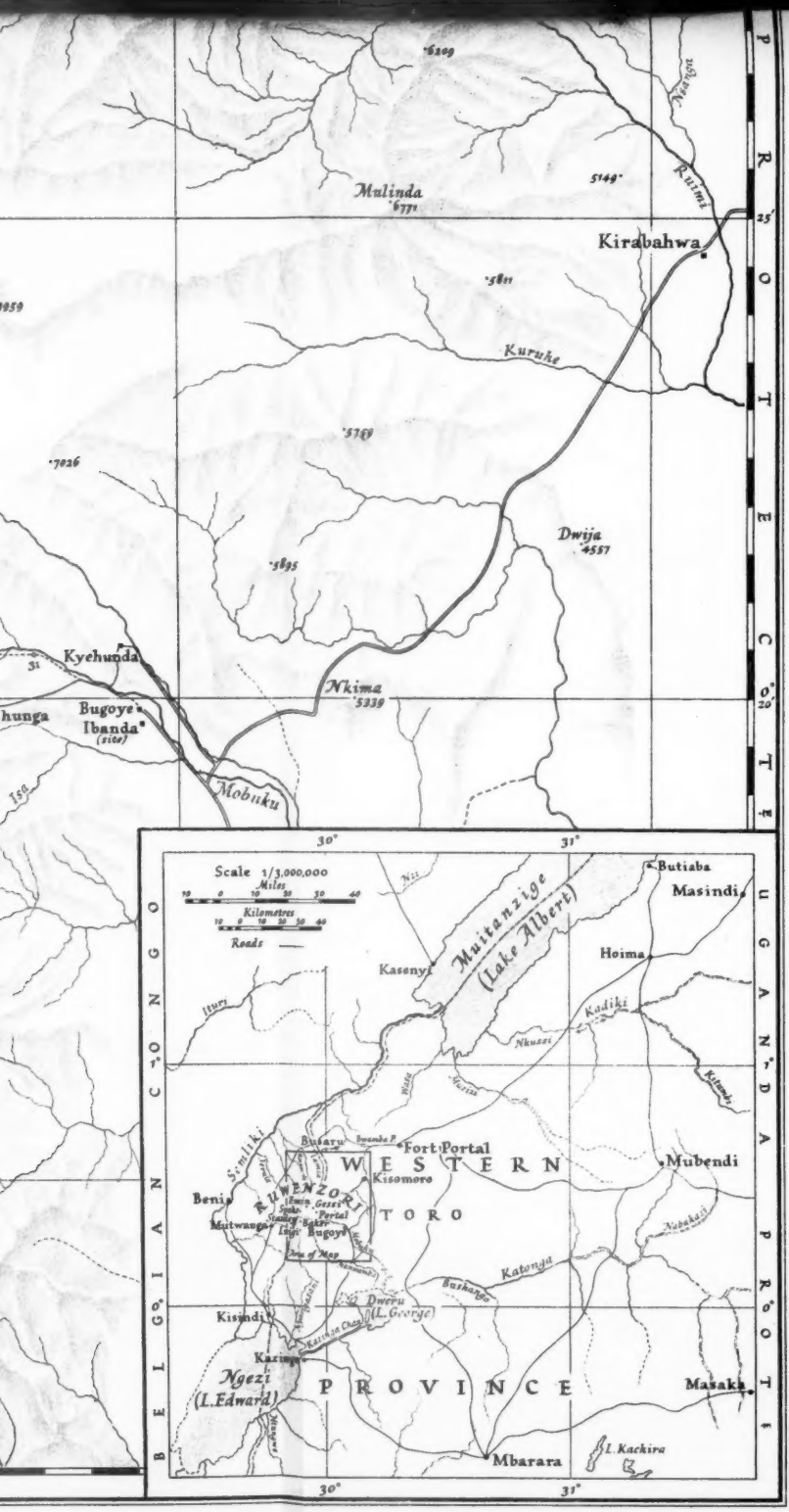

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